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VIEWS, NEWS AND INTERVIEWS.

A recent visitor to one of the smaller cities, not 1,000 miles from New York, observed a curious phenomenon each night during his visit of a week. At 11 o'clock at night the electric lights in the hotel where he was staying went out, and for a period of 10 minutes the house was in darkness. At about 11.10 the lights began to glow again, and were soon in full swing. Being of an inquiring turn of mind, as well as an electrician, he sought to discover the cause of this curious business, and, consequently, visited the electric light station a few minutes before 11 o'clock one evening. He discovered that the station was equipped with a duplicate set of engines and generators, one set being in service at a time. It seems that the station possessed but one belt, and when it came time to shift the load from one machine to the other, a period of darkness was caused by the dynamo attendant shutting down one engine and transferring the belt to the other engine and dynamo. Thus the time lost in this novel and economical procedure constituted the period when the customers of the company failed to receive light.

A London paper says that an American syndicate has offered to purchase the municipal electric light plant at Shanghai, China, on condition that it shall have the right to establish electric railways.

The Rochester, N. Y., Railway Company, of which Mr. T. J. Nicholl is vice-president and general manager, publishes a little paper called *The Four Corners*, which gives information about the pretty places to be visited on the company's cars. "The Kickers' Column" contains this item:

If you get on to the wrong car, swear at the conductor for not knowing on sight what route you wanted to take. He knows what swear words are. If the conductor tells you not to alight from the car until it stops, jump right away and slide on your coat-tails for a rod or so in the mud and slush. Then swear at the conductor for his stupidness. He wont mind. If the car raises the dust, blame the conductor for not sprinkling the streets.

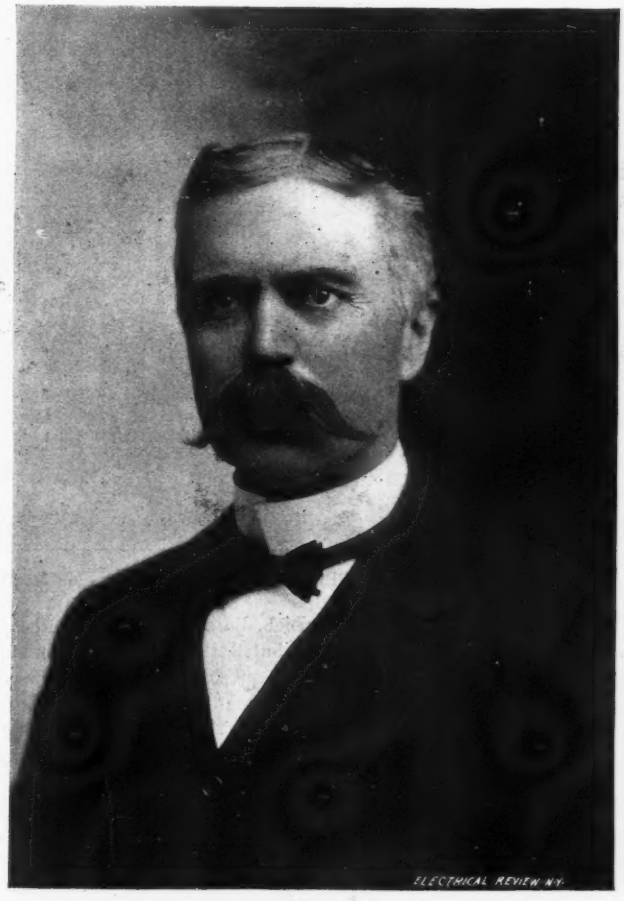
If the conductor or motorman is well and neatly dressed, call h'm a dude, and ask how much he swipes from the company. If he is not neatly dressed tell him he looks "awful," and should be ashamed of himself. Have a kick coming all the time. Don't forget yourself.

The American Institute of Electrical Engineers has recently appointed H. F. Parshall, 83 Cannon street, London, local honorary secretary for Great Britain, and James S. Fitzmaurice, 210 George street, Sydney, N. S. W., local honorary secretary for Australasia.

The Colorado & Southern Railroad will replace the Pintsch lights on its locomotives and cars with incandescent lights.

There has been received from the director of the Italian journal, *L'Elettricità*, in Milan, a request for portraits of "authors, professors, inventors, technicians, etc., in the electrical field," which are to be exhibited at the International Exposition at Como, now under way to celebrate the centennial of the invention of the electric battery by Volta. It is requested that all persons particularly identified with electrical pursuits will send their photographs and autograph signatures to the director at No. 11 Via Cusani, Milan, Italy.

The Toledo, Ohio, Traction Company has granted an increase of five per cent in wages to employés, who will thus receive one cent per hour more than the union scale calls for. About 600 men are benefited.



GEN. S. T. CARNES, OF MEMPHIS, THE NEW PRESIDENT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION. (See Page 343.)

ELECTRIC LIGHT ASSOCIATION'S CONVENTION.

The Twenty-second Annual Session of this Important Body of Electrical Men.

REPORT OF SECOND AND THIRD DAYS' PROCEEDINGS—THE AUTOMOBILE PROCESSION—ELECTION OF OFFICERS—CLOSING SCENES.

The proceedings of the first day's session of the Twenty-second Convention of the National Electric Light Association, held in New York city May 23, 24 and 25, were described in the last number of the ELECTRICAL REVIEW.

MORNING SESSION, MAY 24.

On Wednesday morning, May 24, the session was resumed in the convention hall of the Madison Square Garden, New York.

Letters from First Vice-President E. W. Rollins, S. A. Duncan, C. H. Wilmerding, Edward L. Nicholls and Guglielmo Marconi were read, regretting their forced absence from the convention. Mr. Herbert A. Wagner, of St. Louis, then read his paper entitled "Single-Phase Distribution." The discussion was opened by Mr. Oscar T. Crosby, and participated in by Messrs. Emmet, Ferguson and Perkins. The discussion was long and interesting. At its conclusion Mr. Louis A. Ferguson, of Chicago, read his paper entitled "Underground Electrical Construction." This paper was elaborately illustrated by means of lantern slides, and was read in an adjoining hall which was darkened to permit the use of the projecting lantern.

Mr. Ferguson's paper was discussed by Messrs. Stetson, Gille and Barstow for a few minutes, and the meeting adjourned until 3 P. M.

AFTERNOON SESSION, MAY 24.

At the afternoon session, after a short resumption of the discussion of Mr. Ferguson's paper, Mr. E. A. Leslie, New York, read his paper entitled "Some Notes on Underground Distribution of Two-Phase Current in New York City." There being no discussion, Mr. W. L. R. Emmet, of Schenectady, read his paper entitled "Means of Attaining Safety in Electrical Distribution." After some remarks by Messrs. Sachs and Barstow, Mr. Greene called the attention of the association to the importance of securing modifications in the existing fire underwriters' rules concerning a grounded neutral in a secondary distribution system, as brought out in Mr. Emmet's paper, and suggested the appointment of a committee for the purpose. A motion to that effect was carried.

On account of the absence of Dr. Louis Bell, its chairman, the Committee on Standard Candle-Power of Incandescent Lamps had no report to make. The question of continuing the committee was laid aside for action in executive session. There was, also on account of the absence of Chairman E. A. Armstrong, no report from the Committee on Legislature Regarding Theft of Electric Current. In place of this Mr. G. W. Hubley, of Louisville, Ky., read a paper entitled "Transformers: Iron Loss—Its Increase—The Remedy." In response to a question by Mr. Doherty, Mr. Hubley said that the annealing process he described was carried on at a red heat. The meeting then went into executive session.

At 8 o'clock in the evening Mr. Calvin W. Rice, Brooklyn, N. Y., gave a lecture on "The Development of High-Tension Service," illustrated by lantern slides. The lecture was well attended and highly interesting.

MORNING SESSION, MAY 25.

On Thursday morning the president called the session to order at 10.45 o'clock. After a committee, consisting of Messrs. J. I. Ayer, G. W. Hubley and H. H. Fairbanks, had been appointed to nominate the officers for the ensuing year, Mr. H. M. Atkinson read his paper entitled "Alternating-Current Generation and Distribution—Changes Contemplated in Atlanta."

The discussion which followed this paper was one of the longest and most interesting that has been heard at a convention in recent years. Mr. Atkinson had asked a series of questions, the answers to which would virtually settle the question of the nature of current to be installed in remodeling an old station—whether all direct or all alternating apparatus should be used, the end to be reached being the unification of generating apparatus. Mr. Crosby started the discussion by bringing out opinions from Messrs. Doherty, Scovil, Edgar, Dunham, McCabe, Wright, Coughlin, Brophy, Kershner, Davis, Ayer, Hoag, Bean, Goldsborough and Brown on the subject of alternating-current arc lamps. It seemed to be the consensus of opinion that the alternating lamp was the best for street arc lighting and that, especially when burned in series, they are satisfactory for interior lighting. Much interest was then aroused by reference to the subject of the future relation of the central station business and automobiles. After a momentary pause, to allow the passage of a motion by Mr. Brown for the appointment of a committee to investigate photometry of arc lights, the discussion turned upon the larger question of the desirability of each kind of current—direct or alternating—to the customer. Messrs. Lieb, Barstow, Lisle and others contributed their views on this subject. The president closing the discussion on account of the late hour, a resolution by Mr. Wright thanking the various automobile companies for courtesies extended in the automobile ride Wednesday afternoon was passed; also one by Mr. Dunham, expressing the thanks of the association to Columbia University and to Prof. G. E. Sever. Adjournment was then taken until the afternoon session.

AFTERNOON SESSION, MAY 25.

Reconvening at 3.30 P. M., invitations to visit the Edison stations in the city and to attend a convention of the National Association of Electricians were read.

Mr. Paul Spencer, chairman of the Committee on Standard Specifications for Electrical Apparatus, stated that the committee could present no formal report. It was continued for the ensuing year. Mr. J. I. Ayer then made a verbal report of the Committee on Amendments to Freight Classification.

The discussion ensuing on this report was participated in by Messrs. Davenport, Young, Bean, Crosby and Davis, at the conclusion of which the committee was authorized to take whatever further steps might be deemed advisable, in their judgment, to secure such amendments to the freight classification as were desirable and proper.

A resolution of thanks was then extended to Mr. Tripler for a lecture upon "Liquid Air," which he proposed to give to the members.

The meeting then adjourned to executive session. The first business was the report of the secretary and treasurer. The report showed the following financial transactions during the year:

Receipts and cash on hand	$7,188 90
Disbursements and liabilities	4,551 85
Balance	$2,637 05

The report of the Nominating Committee was then presented: For president, Gen. S. T. Carnes, Memphis, for first vice-president, O. T. Crosby, Washington, D. C.; for second vice-president, J. B. Cahoon, Elmira, N. Y. For members of the Executive Committee, E. F. Peck, New York city; William M. Brock, Paterson, N. J.; C. E. Scott, Bristol, Ct. These gentlemen were formally elected in the usual way.

Upon motion of Mr. Crosby a vote of thanks was tendered by the association to retiring President A. M. Young. Mr. Young made a few felicitous remarks, and appointed a committee to escort President Carnes to the chair. After a few appropriate remarks upon his part the twenty second convention was finally adjourned.

A GROUP OF MEMBERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION—PHOTOGRAPHED ON THE ROOF OF MADISON SQUARE GARDEN, NEW YORK CITY.

ALTERNATING-CURRENT GENERATION AND DISTRIBUTION.*

CHANGES CONTEMPLATED IN ATLANTA.

BY H. M. ATKINSON.

By way of preface, I can not help saying that I feel the compliment of being asked by your president to prepare a paper for this convention. I racked my brain for a long time for a subject (municipal ownership being rather old), and then it occurred to me that the problem which faced us in Atlanta would interest the members of the association, and so my only attempt will be to state briefly and plainly our conditions and the solution of them that we have worked out, though the latter is subject to change. I have not prepared this story (rather than paper) with the hope of teaching this convention or its members anything, as I feel that this would be presumption on my part, but with the strong desire that it will receive attention, and will bring out discussion which will teach us and aid us in perfecting our work.

We feel that we have a company in Atlanta that is a success. It has paid the people well who invested their money in it, and is doing so to-day. It is producing current at what we consider a low cost per kilowatt. With a successful record in the past, with everything running smoothly and satisfactorily, and with a bright outlook for a constantly increasing business, it is a hard thing to face radical and expensive changes, but the growth of our business forces us to act. We concluded that we must have increased capacity to carry our load during the coming Fall and Winter. Two alternatives faced us—first, should we go on and add in conformity to our present equipment; or, second, should we depart radically from our past methods, and, as it were, take a fresh start.

We have labored under many disadvantages during the past eight years and could never feel that when we bought a thing it was permanent or standard; consequently, what we bought was usually bought to meet an immediate want without any definite and fixed policy as to future business and the methods of handling it. Ten years ago our station was considered a model of its kind. To-day it is practically obsolete.

The station has seven large engines in the engine-room, all of different sizes and all differing in many particulars, but all good engines of their kind. Most of these belt to counter shafting and the counter shafting belts up to 37 small units. Three kinds, or perhaps more correctly, four kinds, of current are generated and distributed. The shafting is so arranged as to give great flexibility and so as to enable the engines to work to their best steam economy. The engines are compound condensing, and the boilers, designed to work at a pressure of 110 pounds, have done excellent work, and are doing excellent work to-day. As the business grew, a 1,000-horse-power engine with a direct-belted, two-phase (used as a single-phase) generator was added, two sides of the alternator being balanced for 1,000-volt distribution now, as always, in use.

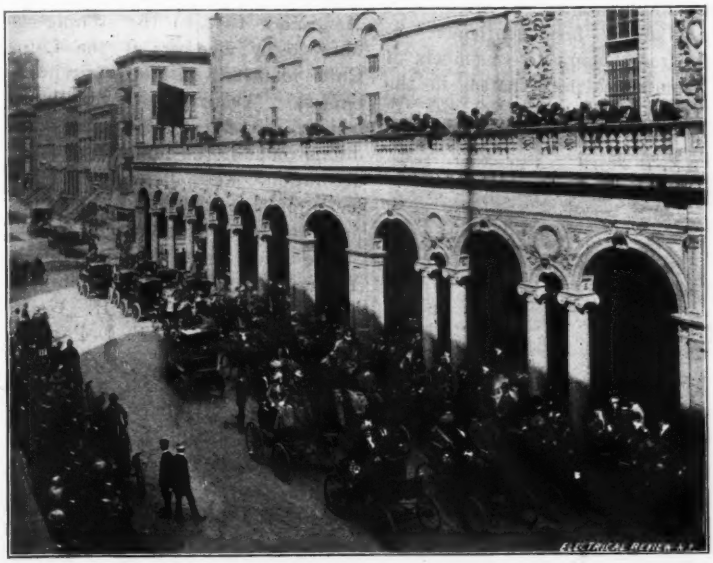
Our dynamo-room contains a number of small 1,000-volt alternators, three different kinds of direct-current series arc machines and four different kinds of power machines. The small alternators work at 125 cycles, while the large direct-belted unit works at 133 cycles. If we should add to this machinery, should we not be going on in a wrong course? Is not the periodicity of 125 or 133 too high?

We believe that development of the alternating current business has progressed far enough for us to be able to say that—if not to-day, certainly to-morrow—power and lighting, induction motors, direct-current motors, arc and incandescent business, will come from common generators sending out only one kind of current. This ideal condition will accomplish the same steam economy as was originally intended with the counter shaft, and with as much flexibility, for as the load increases we can add complete units, which will be large and direct-connected.

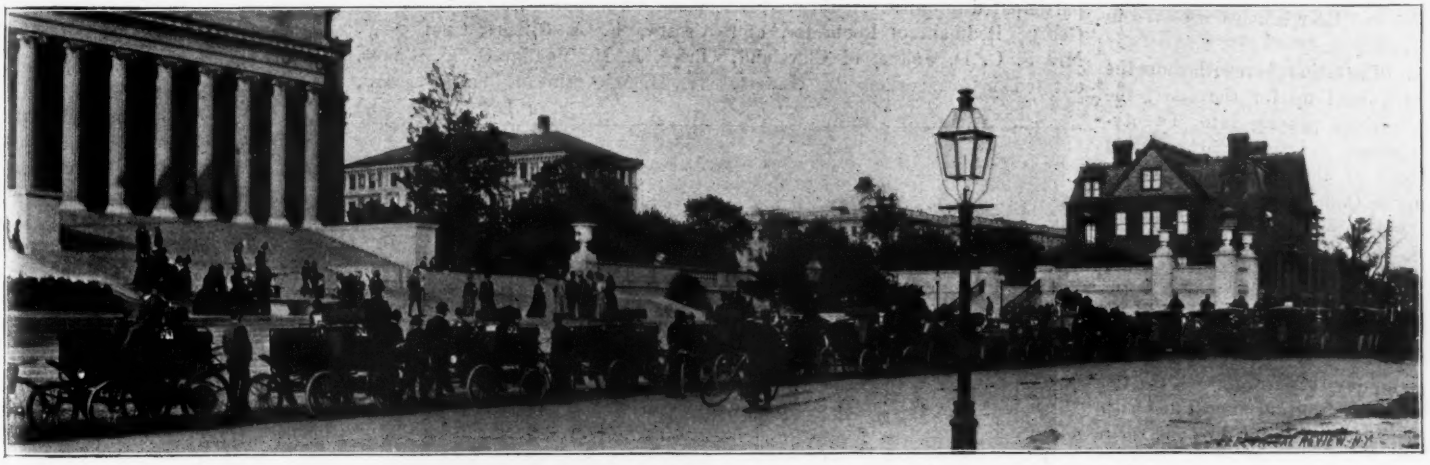
The different kinds of current that our station is generating to-day are as follows: 133-cycle, 1,000-volt, single-phase, 125-cycle, 1,000-volt, 500-volt direct current, 500 volt direct-current railway, 10-ampere direct-current arc, from three kinds of machines; and to do this work we are operating thirty-seven dynamos and generators and seven exciters. This complicated and varied equipment is the natural result of the state of evolution that we have been going through, and I do not think that anybody can be rightly blamed for it.

(To be concluded.)

* Abstract of a paper read before the National Electric Light Association, New York, May 25, 1899.



THE NEW YORK ELECTRIC AUTOMOBILE PARADE—REVIEW OF VEHICLES AT MADISON SQUARE GARDEN BEFORE THE START.



THE NEW YORK ELECTRIC AUTOMOBILE PARADE—THE VEHICLES IN FRONT OF THE LIBRARY AT COLUMBIA COLLEGE.

The Great Electric Automobile Parade in New York.

The automobile procession was started from Madison Square Garden at 2.30 P. M., on May 24. The illustrations herewith give a general idea of its appearance at the start. No less than 51 vehicles took part, and the parade was not only the first of its kind ever held in this part of the United States, but also the largest ever taking place outside of Paris.

The route of the parade was Madison avenue to Twenty-sixth street, to Fifth avenue, to 111th street, to Lenox avenue, to 110th street, to Morningside avenue, to 119th street, to 117th street, to Amsterdam avenue, to Columbia University, where the parade was dismissed. It was said that more different styles of electric carriages were in line than were ever seen anywhere before.

The procession was led by Mr. J. M. Hill, of the Columbia company, and Mr. James H. Godfrey, of the Exhibition Committee, in a Columbia phaeton.

Col. A. A. Pope, driving his stanhope, with C. O. Baker, Jr., president of the Electrical Exhibition Company on the box seat, and a coachman in tweed livery behind, came next. Following Col. Pope came Mr. Riker, of Brooklyn, also in a stanhope, Mrs. Lyon on the box seat. Then came Mr. Lyon's body break, with Mrs. Riker on the box seat, and Mr. and Mrs. Willis Holly, Henry Villard in a dos-à-dos, and George F. Porter in a Victoria. Others in line driving their own vehicles were Luther Stieringer and Marcus Nathan. Among the ladies who rode were: Mrs. Godfrey, Mrs. J. C. Young, Mrs. J. M. Hill, Mrs. Marcus Nathan, Mrs. C. L. Edgar, Mrs. Eckert Chandler, Mrs.

H. C. De Camp, Mrs. W. L. Candee, Mrs. W. J. Hawley, Mrs. W. S. Barstow and Mrs. Charles T. Hughes.

Besides the carriages mentioned there were light phaetons, road wagons, broughams, handsoms, landaus, theater wagons, two-seated phaetons, carryalls and Chariotees. About half the carriages in line were driven by their owners. It was originally intended by the promoters of the parade to go through Central Park and up Riverside Drive. After the squad of bicycle policemen, who escorted the parade, had passed the entrance to the Park at Fifty-ninth street, many of the paraders knew for the first time that automobiles are not allowed in the Park. It was not until the head of the line reached 119th street that it was known that parades, ordinarily, are not allowed on Riverside Drive. As it was, the route taken made it necessary to climb and descend several small hills, and it was said that electric automobiles have never been put to a more severe test. All the carriages remained in line until the parade was dismissed.

Arriving at Columbia University, the participants in the parade were the guests of Professor Seaver, of the Department of Electrical Engineering. The library, west hall and gymnasium were thrown open to the visitors and later lunch was served in west hall.

The illustrations herewith show the vehicles lined up for the start, the first carriage passing into Twenty-sixth street, and the vehicles halted in front of the library building at Columbia College.

It was intended to return by way of the Park, but permission could not be obtained.

The procession was a great success and was heartily enjoyed by all who took part. The following gentlemen from among the exhibitors at the Electrical Exhibition co-operated with the committee appointed by the Electric Light Association in making the arrangements for the ride:

Mr. Harry G. Osburn, American Electric Vehicle Company; Mr. I. H. Kuh, Fischer Equipment Company; Mr. J. M. Hill, Columbia Automobile Company; Mr. A. L. Riker, Riker Electric Motor Company, and Mr. R. M. Barwise, Indiana Bicycle Company.

The Steamboat Ride for the Ladies Attending the Electric Light Convention.

The committee on entertainment appointed by President Young, of the National Electric Light Association, among other events arranged for a boat ride for the ladies around Manhattan Island, extending from above Hell Gate past the Navy Yard down to the Narrows, and up the Hudson River as far as Grant's Tomb and the Palisades. About 100 ladies and a few gentlemen escorts from among the members of the committee participated in the

THE NEW YORK ELECTRIC AUTOMOBILE PARADE—THE FIRST CARRIAGE.

excursion, which was very highly enjoyed, the day being a delightful one for such an occasion. Between the intervals of sight-seeing some old-fashioned dances were indulged in on the deck of the steamer and were participated in quite generally. Mr. George Redman, of Rochester, and Mr. S. C. D. Johns, of Cleveland, entered into a cake-walk contest,

THE NEW YORK ELECTRIC AUTOMOBILE PARADE—WAITING FOR THE SIGNAL TO START.

Rochester carrying off the honors, and the prize was presented to Mr. Redman. Lunch was served on board. The boat returned to its landing at East Thirty-first street about 5.00 P. M., and the well pleased party separated at that hour. A vote of thanks was given with much enthusiasm to the the committee, which consists of Mr. Theo. Beran, Mr. W. L. Candee, Mr. L. F. Requa, Mr. W. F. Zimmermann and others.

Electrical Men Dine at the Lotos Club.

A number of the prominent members of the National Electric Light Association were handsomely entertained at dinner at the Lotos Club, New York City, on the evening of May 25, by members of the Lotos Club identified with electrical interests. About 40 covers were laid on a horse-shoe table in the main dining-room of the club. The floral decorations were elaborate and the menu of that character which has made the Lotos Club famous.

The hosts were Messrs. A. M. Young, J. G. White, H. L. Shippy, C. O. Baker, Jr., E. H. Wells, Charles W. Price, H. F. DePuy, G. H. Walbridge, H. H. Harrison, G. G. Heye, Ralph L. Shainwald and W. G. Bushnell. The guests were welcomed to the club by Mr. Young, and brief addresses were made by Messrs. Huntley and Ayer, ex presidents of the National Electric Light Association. Messrs. Price and Martin responded for the electrical press, and entertaining remarks were made by Messrs. Gilbert, Terry, Wells, Vail and Baker.

Among those present were Messrs. W. L. Robb, Henry Hayes, E. F. Peck, Louis A. Ferguson, E. H. Wells, Marsden J. Perry, O. T. Crosby, F. A. Gilbert, Charles W. Price, A. M. Young, C. O. Baker, Jr., H. M. Atkinson, Barton Sewall, J. G. White, James I. Ayer, H. F. DePuy, George H. Walbridge, Stephen L. Coles, H. T Anderson, Thomas E. Murray, George F. Porter, Marcus Nathan, Ralph L. Shainwald, H. H. Harrison, G. G. Heye, C. A. Terry, W. G. Bushnell, H. L. Shippy, J. H. Vail, T. Commerford Martin, E. A. Leslie, Luther Stieringer, George A. Redman and Charles R. Huntley.

Some German Acetylene Statistics.

Two of the German acetylene journals have become interested in the statistical side of that industry, and have collected and published considerable data upon the subject, says the *Scientific American*. One of these journals, *Das Acetylen* sent out blanks and received answers, from which the following figures were derived.

In 1898, in the German acetylene apparatus shops, there was sold:

Generators	6,451
Burner capacity of each generator	1 to 300
Total burner capacity	112,355
Candle-power of burners (in Hefner candles)	10 to 60
Candle-power of burners (in Hefner candles), total	3,182,100
Average burner capacity of generator	17
Average candle-power of burner in Hefner candles	28

The demand was greatest for apparatus having a capacity of 15 to 30 burners.

Upon the basis that the generation of one Hefner candle (0.888 English candle) requires 0.0265 cubic feet of acetylene, the above capacity of 3,182,100 candles would require the consumption of 84,325 cubic feet of acetylene. If one pound of carbide generates 4.8 cubic feet of gas, there was therefore required a supply of 17,567 pounds of carbide per hour, or, on a basis of a yield of 4.46 cubic feet per pound, an hourly consumption of 19,000 pounds of carbide. Counting 1,900 burning hours per year, the yearly demand for carbide was respectively 16,688 and 18,050 short tons. Taking the price of carbide at four cents per pound, or $80 per ton, we see that the sales must have aggregated, for 16,688 tons consumption, about $1,335,040; this sum doubles itself when we consider that but about half the German and Swiss production of carbide is used in these countries, and therefore that at least $2,770,000 worth of carbide was turned out during 1898.

Generators having a capacity of 25 burners are most in demand, and most of this size are sold. The average price being $125, and 6,451 of these being sold, would bring the total up to $806,375. Calculating that one burner costs 25 cents, the 112,355 burners going with these generators will cost $28,089. The carbide works and acetylene apparatus manufacturers in Germany therefore did a business in 1898 amounting to $3,604,464.

The nine largest acetylene firms in Germany have a capital of $1,122,500, and the smaller firms, having a capital under $25,000 each, will agregate $153,750, making a grand total of $1,276,250. There are 1,020 men employed in the shops.

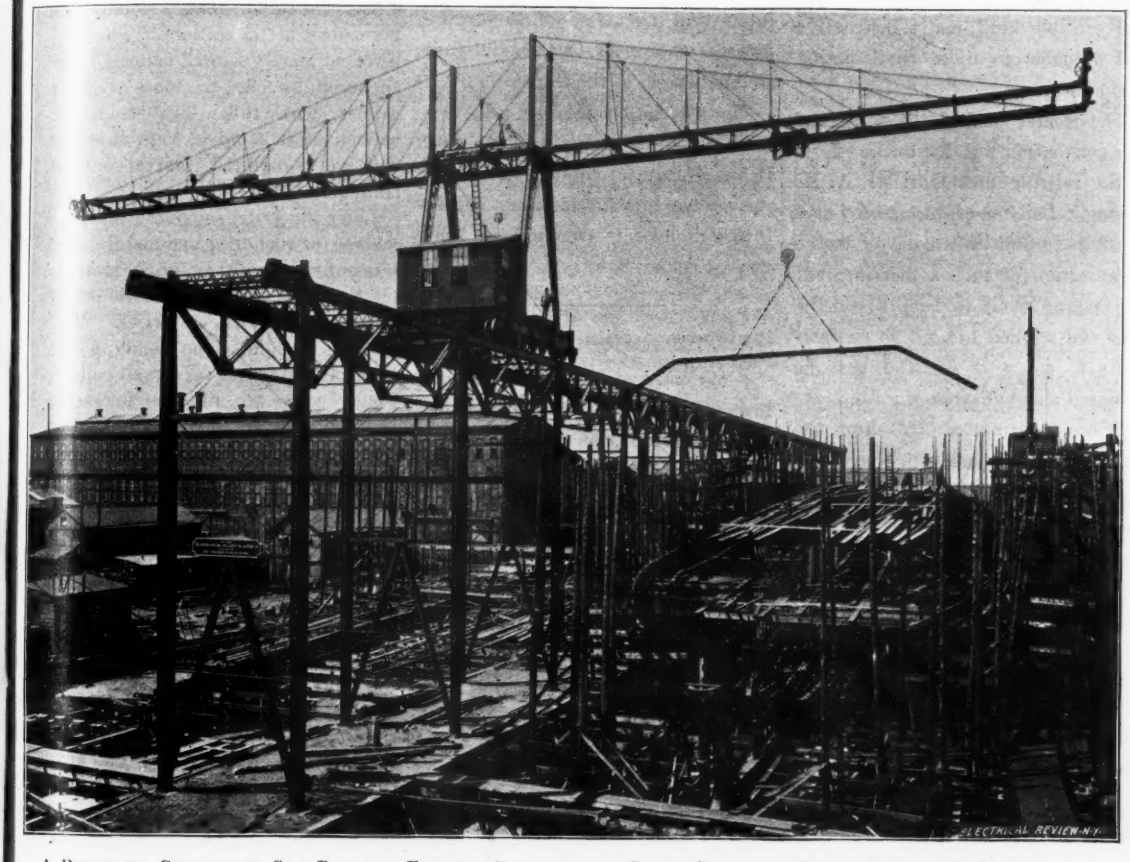
A Powerful Cantilever Ship-Building Electric Crane.

The first of three large cantilever ship-building cranes, designed and built by the Brown Hoisting and Conveying Machine Company, of 26 Cortlandt street, New York, and Cleveland, Ohio, for the William Cramp & Sons' Ship and Engine-Building Company, of Philadelphia, has just been put in operation, and is shown in the accompanying illustration. This crane is driven by a single electric motor of about 150 horse-power, built by the Elwell Parker Electric Company, also of Cleveland.

The crane is mounted on a steel trestle of special design, 60 feet high, giving a total height from the ground to the underside of the cantilever arm of 92 feet. The crane has a clear travel up and down the trestle of 725 feet, and has a lifting capacity of 15 tons at 60 feet out on either arm, or five tons at 95 feet out on either arm. The total length of the two cantilever arms over all is 202 feet.

The gauge of track along which the crane runs on top the trestle is 20 feet, and the entire crane has a speed up and down the trestle, with loads, of from 500 to 700 feet per minute against the wind. It will hoist its maximum load 125 feet per minute, or five tons 350 feet per minute, or 1,000 pounds 700 feet per minute, and has a trolley travel along the cantilevers of 800 to 1,000 feet per minute.

This crane, which is known at the Cramp works as the "Battleship Crane," covers two battleship ways, at present occupied as shown in the engraving. On the right-hand side is a 13,000-ton battleship for the Russian Government, and to the left in the picture is shown the keel of the new battleship "Maine," on which construction is just beginning. Both crane and trestle were designed and built for the Cramp company by the Brown Hoisting and Conveying Machine Company, who now have in construction two more such cranes and trestles for the same company.



A Powerful Cantilever Ship-Building Electric Crane at the Cramp Shipyards, Philadelphia—The Keel of the New United States Battleship "Maine" is Shown at the Left of the Picture.

The Southern Bell Telephone Company has filed at Raleigh, N. C., exceptions to the recent order of the corporation commission fixing and reducing rates. The company says the rates ordered are unreasonably low and also unconstitutional.

Telephone News .....and Comment

It is rumored that the New York Telephone Company has purchased the property at the southwest corner of Eighteenth street and Irving place, New York city, on which a telephone exchange building will be erected.

Work has commenced on the new brick building on Mill street, Spokane, Wash., to be occupied by the Inland Telephone and Telegraph offices and operating rooms. Work will soon begin on the system of underground conduits for the wires of the company.

Judge Ricks at Cincinnati has rendered a decision denying the application of Postal Telegraph Company for a right of way over the Big Four Railroad. The judge held that a foreign corporation had no such right under Ohio laws as that claimed by the Postal company.

The Board of Trade, Chicago, after a long and extensive investigation, have decided to put in an independent telephone equipment in their private exchange. This will without question be one of the most important and influential private systems that has ever been installed. The plant will be equipped with a 200-line Stromberg-Carlson central energy system.

The Imperial Diet of Japan last February voted to expend $12,800,000 within the next seven years for the improvement of the government telephone system, and a young electrical engineer, named Rinja Nakayama, has been sent to the United States for the purpose of investigating the latest inventions and improvements along that line. Japanese electricians will do all the work.

P.G. Reynolds, general superintendent of construction of the Northwestern Telephone Exchange Company and also of the Southwestern Telegraph and Telephone Company, has been appointed to a similar position with the Wisconsin Telephone Company. E. D. Trowbridge, superintendent of the long-distance service of the Michigan Telephone Company, has been appointed to a similar position in the Wisconsin & Northwestern companies, giving him charge of the long-distance service in Michigan, Wisconsin, Minnesota and North and South Dakota.

The directors of the Chicago Telephone Company have decided to sell at once 6,635 additional shares of stock, making the entire amount outstanding $5,000,000, the full amount authorized. They have also decided to recommend to the stockholders at the next annual meeting that the capitalization be increased to $15,000,000. The company has now under construction four or five buildings about the city, in which its branch exchanges are to be established, and is constantly increasing its list of subscribers. When authority is obtained to treble the capitalization at the annual meeting next January, shares of the new stock will be offered to stockholders at par, from time to time, as money is required for extensions and improvements. At the beginning of the present year the company had in operation 21,876 telephones, of which 17,514 were in Chicago and the balance in the 10 counties of Illinois and Indiana which the company controls. The company was organized in 1881 with an original capital of $50,000.

Electrical Review

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News, Subscriptions and Advertisements.

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CHANGES for advertisements must be in this office by Friday noon for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week, although it is occasionally possible to get in matter received on Monday.

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THE ELECTRIC LIGHT CONVENTION.

The twenty-second annual convention of the National Electric Light Association, which has just ended its sessions in New York city, was in many ways one of the most successful in the history of that organization. Not only was the attendance large and the attention to the business in hand marked, but both papers and discussions were of a practical and sensible kind, really instructive and valuable to those participating in the meetings.

The greater part of the success of this convention was due to the efforts of the retiring president, Mr. A. M. Young. It is not easy for a busy man of affairs to find time to devote to the organization of such a meeting, but Mr. Young seems to have found the time and applied himself so energetically to the work in hand that he achieved a signal success.

These meetings always show the trend of advancement in the great branch of the electrical industry that they represent. This year the most significant facts, probably, that were developed in the discussions were the movement toward unification of current supply and the great and increasing importance of the electric automobile. It seems to have been established that direct-current generation, whether for supply at constant pressure or for arc lighting, is going out of fashion. The vastly superior simplicity and flexibility of polyphase generators, coupled with their great efficiency; the ease with which all sorts of transformations of this variety of current can be made; the growing perfection of the alternating-current arc lamp, all point to the retirement of the direct-current generator for central station service.

But it is the automobile that really interests central station managers just now. Here, apparently, is the direction in which the next great extension of the field of electrical application will take place. It does not require a prophet to see that the future of self-propelled electric vehicles will be a great one, or to note the fact that the automobile is, to-day, where the electric street railway was ten years ago in point of development. The chances are favorable for an even more rapid development in the newer field. Here, then, is a vast market for electrical energy in the future. How to meet its demands, and to prepare for the new conditions that the automobile will create, are vital and immediate questions for every central station manager to consider. It is to be regretted that the interesting discussion of these matters was shortened by the brief time at the disposal of the convention.

The association deserves congratulations upon its extending usefulness. It has already accomplished much for the electric lighting industry, and its future promise is even greater than its past achievement.

THE STORAGE OF AUTOMOBILES.

A curious fact is brought to light in an interview with one of the gentlemen now forming an automobile club in New York. It is that no livery stable will store an automobile on account of the horsemen's prejudice against these vehicles, consequently the owner of an automobile has to provide a private storage place for it, at considerable trouble and expense. This sort of opposition to improvement is reminiscent of the early days of the steam engine, when several of them were destroyed by laborers jealous of the new invention. If the livery stablemen were wise they would begin now to put in stalls and charging accommodations for electric vehicles to replace the horses and carriages that a few years' progress will send to the limbo of forgotten things.

THE NAME CONTEST.

Owing to the very large number of names descriptive of the "self-propelling, self-contained electric vehicle" received, and pressure of business affairs upon the members of the committee chosen to select the winning names, it is unfortunately necessary to defer the announcement of the prize winning names. These we hope to announce in the next issue of the ELECTRICAL REVIEW.

A SUGGESTION IN WIRELESS TELEGRAPHY.

TO THE EDITOR OF ELECTRICAL REVIEW.

Some time ago you published * a communication from the undersigned bearing upon the efforts then being made at Blue Hill Observatory to obtain meteorological records from comparatively high elevations by means of kites. The kite at its best being available only in certain favorable wind conditions and only while such conditions last, the writer suggested a plan for establishing a number of permanent aerial stations. The plan involved merely a small balloon, to be anchored by one or more steel or copper wire tubes, by which the balloon aloft could be kept supplied with gas at required intervals or continuously.

Later the writer suggested the same scheme for anchoring and maintaining transmitting and receiving stations for Mr. Tesla's plan for electric power transmission without wires. The same idea would come handy in the Marconi system. A very small balloon would suffice to lift the necessary apparatus and could be maintained at any desired height indefinitely by the use of a fine metal tube to serve both as anchor wire and gas supply from a reservoir or pump on the ground. The balloon, if necessary, could easily be prevented from spinning and all directive operations could be controlled readily. The small tubular wire would also serve as carrier for the insulated wire required by the system.

Thus it would be a simple matter to establish stations at altitudes of from 5,000 to 10,000 feet. And even if very long-distance transmission be hereafter found impracticable, the balloon plan would serve for distances which otherwise would require very costly towers to be constructed.

A steel tower 1,000 feet high is an item of grave consideration, on account of the great cost. The cost of a balloon of small size, at a height of 5,000 feet, would be a mere bagatelle in comparison.

The United States Signal Service could easily include the two balloon stations in the experiments now making, and I am inclined to think the results at, say, 1,000 feet elevation, will, even for short distances of transmission, prove surprisingly good. It would, at least, seem well worth the trial.

T. J. MCTIGHE.

New York, May 28.

* See ELECTRICAL REVIEW, October 30, 1897, page 191.

SINGLE-PHASE DISTRIBUTION.*

BY HERBERT A. WAGNER.

In the transmission of power to operate large motors, both the two and three-phase systems are superior to the single-phase, although time may even modify this condition.

Simplicity is one of the prime requisites in an electrical installation, and the multiplication of parts or members decreases or eliminates it. It is hardly necessary to go into the the details of the complications to which polyphase distribution may lead, but of these the multiplication of wires is the very least. The complication of the switchboard apparatus and appliances, and also those used in connection with local distribution and services is most discouraging.

Consider, for instance, low-tension local distribution mains on the three-phase system in combination with the Edison three-wire system, making six circuits to equally divide your lamps between in such a manner that the balance will be maintained quite nearly at all times, at each or adjacent customers.

In all successful low-tension distribution systems junction boxes are used at street intersections. These are arranged for distribution in four directions, and at feeder terminals and some other intersections are quite frequently six way boxes. Imagine such boxes with 24 or 36 cables entering them. The neutrals in such a system could never be allowed to ground as they would all three be at different potentials. It is absolutely impracticable, and the three-phase advocate will answer by saying that he would separate his circuits for general distribution and run his lighting circuits single-phase, using his three phases each for a different district or section of a district. For power customers he would use all three circuits of course. Now, every one who operates a large central station knows how impossible it is to separate light and power. Small motors are required by almost every lighting customer. If the solution then is to use single-phase motors for small powers, where is the size line to be drawn? Single-phase motors can be made just as efficient as three-phase. True they will cost more if so made, but when the saving in cost of transformers and distribution devices is considered, the balance is in favor of the single-phase motor.

It must, of course, be borne in mind that the subject now under consideration is general distribution for all electrical applications and not for power distribution alone. We might then be advised that we could confine our three-phase system to our transmission lines and feeders where we could save very greatly in the amount of copper required.

For ordinary distribution in large cities the cost of transmission lines or feeders is but a small proportion of the total cost, where alternating current is used. Of this small proportion we are told we can save 25 per cent. But is this true? It is, as far as copper is concerned, but the cost of insulation, conduits and other construction items does not increase in proportion to the cross section of the copper.

The actual difference in the cost of conductors installed for underground transmission between single and three-phase is almost insignificant. This slight difference can always be made up completely by operating the single-phase at a slightly higher pressure. If the cost of copper alone was considered, the single-phase would have to be operated at a pressure of 15 per cent higher than the three-phase for equal cost. Considering the total cost of line installation, however, this difference would not be over 10 per cent in pressure for overhead lines and less than five per cent for underground lines. Have we ever so nearly reached the safe limit of pressure that any one could say "you can not safely go 10 per cent higher"? Can we not as safely run 10 per cent higher when we have only two-thirds the length of line to operate, and practically but two-thirds of the surface in contact with insulation from which leakage or break-down might occur.

As two-phase distribution requires the same amount of copper as single-phase at the same pressure, it has no point of even apparent superiority, except the debated one of greater adaptability for running motors.

On regulation—and this is a very important factor—the single-phase is far superior to the two-phase or three phase system. I contend that it is impossible to keep two separate feeders supplying current largely used for lighting equally loaded at all times, and it is, therefore, impossible to keep the different phase circuits of two or three-phase systems balanced when used for single-phase local distribution, and we have demonstrated that they must of necessity be so used in practice.

In either the two phase or three-phase systems an unbalanced load on the different phases causes an unbalancing of the pressures on those phases at the generator and consequent difficulty to regulate closely, this being most marked in the three-phase system. In this particular, and in slightly less complication in local distribution, the two-phase system is superior to the three-phase.

It is quite necessary to carefully consider all these characteristics of the three systems in deciding which one to use in any particular case. As I have said, each has a field in which it is the most suitable.

For long-distance transmission for power or rotary transformers only, the three-phase system is most clearly indicated.

For the same service as just stated with a small proportion of lighting, the three-phase current may be transformed to two-phase for the latter, or single-phase current may be used from one of the three-phase circuits.

For shorter transmission and general distribution where rotary transformers are also required, the two-phase system is indicated.

For all general distribution where rotary transformers are not required and extremely large motors starting under load are not to be supplied, the single-phase system should always be used. For cities large and small this class of service is the one usually required, with the exception of cases where it is necessary in order to conform with long existing conditions to supply direct current mains with direct-current from rotaries. Here the three-phase system is of course the most applicable.

I have not considered the use of rotaries with single-phase currents, not because their operation is impracticable, but simply for the reason that none of large capacity have ever been made. They can be made, and so made that they will operate as satisfactorily as on two or three-phase circuits. It would complicate them more to make them self-starting by alternating current, but many two-phase rotary installations have been made which are not self-starting. A separate starting device or motor is used which would be equally as applicable to single-phase circuits. Single-phase rotaries of a given size would have less capacity than two or three-phase and therefore, for a given capacity would cost slightly more. That they will eventually be used quite extensively on single-phase circuits is quite certain.

It was not my intention to digress very far from the subject indicated by my title, but it seemed necessary to clearly define the position and sphere of single-phase work by way of introduction.

(To be concluded.)

* Abstract of a paper read before the National Electric Light Association, New York, May 24, 1899.

The President of the National Electric Light Association.

Gen. Sam T. Carnes, the newly-elected president of the National Electric Light Association, is a leading and popular citizen of Memphis, Tenn. His father was one of the pioneers of Tennessee. General Carnes was born in Hardeman County, West Tennessee, in 1850. He was by inclination a military man, and his early training and tendency have gone far toward making him one of the best known military tacticians in the country. For a long time he was brigadier-general of the state of Tennessee, thus having charge and control of all the militia of the state. This military talent was both inherited and cultivated. His father before him was quite a military enthusiast and expert, and was at one time at the head of the State National Guard. General Carnes was elected captain of the Chickasaw Guards, in the city of Memphis, in 1878. This was at that time decidedly the best military company in the state, and one of the best in the nation. Under his captaincy it became one of the most celebrated companies in the land. To General Carnes is due the introduction of both the telephone and electric light in the city of Memphis, and he has been for years the president and general manager of the Memphis Light and Power Company. General Carnes was married in 1881 to Miss Kate Kerr, of Memphis, and has two charming daughters.

Lieut. Bradley A. Fiske, U. S. N. the inventor of a well known type of electrical range-finder, has been promoted to be a lieutenant-commander.

Association of Railway Telegraph Superintendents.

The eighteenth annual convention of the Association of Railway Telegraph Superintendents met at Wilmington, N. C., on May 17, 18 and 19. The delegates were welcomed by Mayor Waddell. A number of interesting papers were read, among which were the following: "Electric Lighting for Railway Stations," by Charles F. Annett; "Electric Light Plants to Be Located at Railway Terminals," by R. J. M. Danley; "The Protection of Telegraph Lines from High Voltage," by Prof. C. E. Freeman; "Maintenance and Construction of Telegraph Lines," by C. H. Bristol. William Maver, Jr., of New York, delivered an address on wireless telegraphy, and gave a demonstration of Marconi's system. In the evening a musicale and phonograph entertainment were given in the parlors of the Hotel Orton. Among the visitors present was Mr. Thomas A. Edison.

These officers were elected for the ensuing year: President, L. B. Foley, of the Delaware, Lackawanna & Western Railroad, New York; vice-president, W. F. Williams, of the Seaboard Air Line, Portsmouth, Va.; secretary and treasurer, P. W. Drew, of the Wisconsin Central Railroad, Milwaukee.

The second day's meeting was called to order by President Foley on Friday, May 18, at 10 A. M. Mr. E. St. John, general manager of the Seaboard Air Line, sent a letter of greeting, which was read to the delegates. A report of the Committee on Low Resistance Relays was read and discussed at some length. A paper by George M. Dugan on "Underground Office Construction" was read. It was decided to hold the next meeting in June, 1900, at Detroit, Mich.

The final meeting of the convention was held on Friday, May 19, at 10 A. M., at the Monticello, Norfolk, Va. A paper on "Simultaneous Telephony and Telegraphy," by Mr. Charles Selden, was read, as well as one on the same subject by Mr. Thomas D. Lockwood.

The automobile has attained the final distinction of being arrested by a New York policeman for running too fast. Two or three days ago cab No. 1565, of the Electric Vehicle Company, New York, was run down by a bicycle policeman, and led as a victim to a police station, charged with running at 12 miles an hour around a crowded corner.

ROTARY TRANSFORMERS AND STORAGE BATTERIES AS RELATED TO LONG-DISTANCE TRANSMISSION.*

BY PROF. WILLIAM LISPENARD ROBB.

This paper was prepared in response to a request from President Young to give at this meeting of the National Electric Light Association an account of the operation of the rotary transformers and storage battery installed and operated in connection with the long-distance transmission plant at Hartford.

The paper is intended, not as a general treatment of the subject of rotary transformers and storage batteries, but rather as a statement of the conditions under which we operate at Hartford, of the difficulties met with in the operation of that particular plant, the way in which these difficulties have been overcome, and the advantages that have been found in the operation of the rotary transformers and battery. It is hoped that this paper will serve to open a general discussion of the subject, in which all those who are operating rotary transformers and battery stations will participate.

A short description of the Hartford plant seems essential to a clear understanding of the conditions under which the rotary transformers and battery are there operated.

The main source of power is water-power on the Farmington River, approximately 11 miles from Hartford. The water-power at present developed is capable, under the most favorable conditions, of delivering at the switchboard in Hartford about 1,200 electrical horse power. The power is generated by two 600-kilowatt alternators and transmitted to Hartford on the three-phase system under 10,000 volts pressure.

The water-power is supplemented by an auxiliary steam plant in Hartford, consisting of two compound-condensing Couper-Corliss engines, having a combined capacity of 1,600 horse-power. These engines supply the power to operate one 600-kilowatt alternator and one 400 kilowatt rotary transformer, so arranged that it can be connected with engines and operated as a direct or alternating-current generator. This rotary is so operated whenever, owing to low water or repairs on the transmission line, the supply of alternating current is insufficient for the alternating-current load and all the rotary transformers.

Two systems of distribution are used. In the central portion of the city the distribution is on the three-wire, 220-volt, direct-current system. This part of the service is practically all under ground. The feeders are lead-covered cables drawn in cement-lined ducts. The distribution is in part by Edison tubes and in part by lead-covered cables drawn in ducts. Outside the central portion of the city the feeders are supplied with two-phase alternating current under 2,400 volts pressure, and the distribution is, in general, on three-wire, 220-volt systems, supplied from 10 or 20-kilowatt transformers, although a few smaller transformers are still in service. This service is in part under ground, but, in general, overhead. Constant-potential, enclosed-arc lamps, incandescent lamps and motors, in the case of both alternating and direct currents, are operated on the same three-wire system. All the commercial arc lamps, whether on the direct or alternating system, are of the constant-potential, enclosed type, as are also the street lamps in streets in which there is a three-wire system. In other streets the street lamps are of the series alternating-current, enclosed-arc type, and are operated from constant current transformers.

Three rotary transformers supply direct current to the three-wire, direct-current system. One has a capacity of 400 kilowatts, and is located at the steam plant. Two have a capacity of 250 kilowatts each, and are located in a battery substation which is situated in the very heart of the business section of the city, and about three-fourths of a mile from the steam plant. The storage battery has a capacity of 2,500 horse-power-hours at a five-hour rate of discharge. The 250-kilowatt rotaries and the battery were installed in the Fall of 1896, and the 400-kilowatt rotary in the Fall of 1898. All three rotaries and the battery supply currents to the same three-wire system.

The three alternators are always operated in parallel. At least one rotary transformer and storage battery are always connected to the three-wire, direct-current system. The direct and alternating-current systems are consequently interlocked, and the whole plant, including alternators, rotary transformers and battery, is practically operated in parallel.

The rotary transformers are of the two-phase type, and are so designed that by cutting in or out turns of the primary of the static transformers the voltage of the rotaries may be varied between 230 and 360 volts. This wide range of voltage is necessitated by the fact that the rotaries are at times run directly on the line, and at other times used in charging the battery, frequently at high-charging rates. This wide range of voltage that can be obtained from the rotary does away with the boosters, otherwise necessary in charging.

The rotary transformers are two-wire, and simply supply the current to the outside wires of the three-wire system. The neutral wire is connected with the middle point of the secondaries of the two static transformers. This point is always midway, as regards electric pressure, between the two terminals of the rotary transformer.

The storage battery is at all times kept on the line for the purpose of regulation, and to meet any emergency call for extra power.

It was necessary to generate alternating current rather than direct current, as the main source of power is located 11 miles from the center of distribution; this condition very generally applies to water-powers that have not already been developed for other purposes than the production of electricity. The same condition applies in the case of companies supplying large areas when it is desired to supply all the power from one central power plant, so located that the power can be produced at the minimum cost. In the Hartford case, at the auxiliary steam plant, one generator supplies alternating current. The second generator, which in its normal use is a rotary transformer, when supplied with mechanical power from the engines, furnishes both alternating and direct current to the system in any proportions that may be desired.

Two of the rotaries are started and brought into synchronism by induction motors built on their shafts; the third is brought into synchronism as a direct-current motor, the current necessary for this being supplied from the direct-current system.

The direct-current system of distribution was adopted for the central portion of the city, as it was considered the only one on which all kinds of service could be given from the same wires, especially if those wires were placed under ground. In that section of the city a large number of motors are being frequently stopped and started. It is considered that induction motors operated under these conditions would seriously interfere with the lighting service. In sections of the city where the motors are in continuous use—for example, when they are used for running machinery in factories, and consequently are only started twice a day—we find no practical difficulty in operating induction motors and lights from the same system of distribution.

The three alternators, one operated by steam and the other two operated by water-power, at a distance of 11 miles from the first, have been continuously run parallel during the past three years. No difficulty whatsoever has been found in this method of operation.

The operation of the rotary transformers has not been so simple a matter. At the outset there was great excess of sparking at the commutator. This sparking was soon found to depend very largely on the variety of brushes used. It was found that a very soft carbon brush gave the best results, but without special treatment of the brushes, sparking, although diminished, is still excessive. The method of treating the brushes suggested by our superintendent, Mr. Rollins, was tried and found effective. The carbon brushes are first raised to a red heat, and then plunged in ordinary lubricating oil and allowed to cool. When brushes treated in this manner were used all vicious sparking was stopped, and in this particular the transformers ran as smoothly as direct-current generators of the best type. At the outset, in operating the rotaries, considerable difficulty was met with in preventing pumping when the engines were supplying power to the system. This pumping could be traced to the variation in the angular speed of the engines, and when the water-power alone was supplying the power there was little, if any, pumping. It was found that this tendency to pumping could be checked by varying the field excitation of the rotary transformers or by temporarily throwing a portion of the load on the storage battery. Only once in the past three years has the pumping been such as to cause any serious interruption. The switchboard at the substation was originally arranged to give the greatest possible flexibility in operation. Both rotaries could be run in multiple with the battery, or both rotaries could be run in multiple, feeding into the line, and the excess of current used to charge the battery; or one rotary could be run on the line and the second rotary used to charge the battery independently. This last method of operation was found impracticable. Under this condition the pumping would immediately begin, and it necessitated giving up this method of operation. Notwithstanding the above-mentioned difficulties, when a year ago it was decided to increase the direct-current machinery, we had gained sufficient confidence in the rotary system to purchase a 400-kilowatt rotary rather than a direct-current generator.

The third rotary, when tested, proved to be free from any tendency toward pumping, either when operated from the steam plant or from the water power, and was in every way as nearly perfect as a machine could be. However, when thrown on the line with the two older rotaries, they immediately began pumping, and it was found impossible to run the three rotaries together. The pumping in a rotary system seems to be cumulative; it is very easy to stop it if the proper remedy is applied as soon as the first tendency to pump is noticed. If allowed to go on it quickly gets beyond control. The impossibility of running the three rotaries together necessitated some change. The Westinghouse company's engineers maintained that the corrective device could be applied with equal effect to any one of the three rotaries. Copper strips were attached to the pole-pieces of the 400-kilowatt rotary. This rotary, of itself, was all right, but the developing of any tendency of the system towards pumping was

* Read before the National Electric Light Association, New York, N. Y., May 23, 1899.

entirely overcome by means of these copper strips. The system now works perfectly, whether operated by steam or water-power. Even under the trying conditions of running the rotaries under different voltages, two feeding directly into the line, and the third independently charging the battery, no trouble with pumping is experienced. In all other respects the rotary transformers have been all that could be asked for; they have run practically continuously night and day for nearly three years, and have had practically no repairs, the commutators simply being turned down once or twice a year.

With storage batteries one looks for frequent renewals of plates. The Hartford battery has had its share of renewals The battery was bought under a five-year guarantee, which has since been renewed for five additional years. The renewals have not been in excess of what was expected, and no investment of the company has been considered more satisfactory than the battery. The method of deciding when the battery is to be renewed under the guarantee is perhaps interesting. Whenever any plate or number of plates have lost one-third of the original capacity, they are replaced by new plates. In this way the battery is being continually renewed, and its capacity should never be less than 90 per cent of its original capacity.

The four accompanying charts, made from the daily records of the company, were originally prepared for illustrating a short talk before the Connecticut association, and illustrate the general operation of the plant and the relative loads on the different systems. The charts represent the load on Wednesday, November 23, and Saturday, November 26, 1898.

The part shaded with horizontal lines represents the alternating-current load, the upper portion representing the series arc street lights. The part shaded with diagonal lines represents the charge and discharge of storage battery; lines sloping to the right representing the discharge, and lines sloping to the left the charge. The horizontal dotted line represents the total full-load capacity of the direct-current machinery installed on November 23. The unshaded area represents the direct-current load carried directly by the rotary transformers.

An inspection of the charts, representing the direct current system, shows that the average load on the rotaries during the 24 hours was over 80 per cent of their rated full-load capacity. The maximum load on the system was 83 per cent more than the full-load capacity of the rotary transformers.

A comparison of the curves for the two days illustrates the great flexibility of the storage battery. On Wednesday it was used at the high rate of discharge for a short period. On Saturday the discharge was at a lower rate, but was continued for a much longer time.

The upper portion of the area representing battery charge and discharge represents the charge and discharge of an isolated storage battery in one of the department stores.

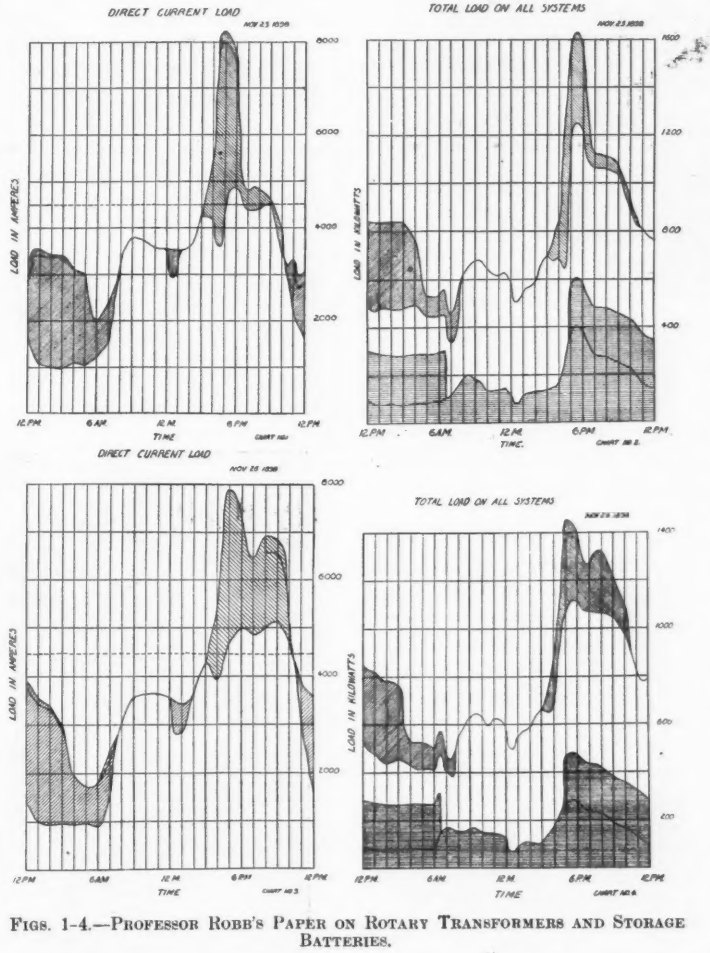
The advantages of the rotary transformer and battery system to the Hartford company have been very great. With the battery the company has been able to use a great quantity of water-power that would otherwise have gone to waste. What would otherwise have been waste water-power has been utilized at the peak of the load at the time when power is most valuable. The total output of the water-power during the past year was over 90 per cent of the possible output. When operating by steam, the engines have been run at an economical load, the advantages of the storage battery being nearly, if not quite, as great in connection with the operation of the steam plant as of the water plant.

The regulation of the system is much better with the battery than it could possibly be without it, and the service is much more reliable. The interlocking of the battery with the alternating current by means of the rotary transformers makes the battery act as a regulator on the alternating-current system as well as on the direct. During the daytime on Sundays the entire load, both direct and alternating, can be carried by the storage battery. The battery has frequently been allowed to feed the alternating system through the rotaries.

The transformer and battery station is operated by three men: the superintendent, an expert in the care of batteries, and two switchboard attendants. The labor in caring for a station of this output is a minimum.

The system could, of course, be operated with direct-current generators connected to alternating-current motors. This would necessitate in the place of each 250-kilowatt transformer one 300-kilowatt motor direct-connected to two 125-kilowatt generators, and a smaller motor direct-connected to two boosters. The result would be a much greater investment in machinery, much greater floor space occupied, greater complication and expense of operation and a lower efficiency.

To sum the matter up, my Hartford experience has convinced me that the most satisfactory method of supplying electric energy over a considerable area is from a central power station generating alternating current; the current being distributed to rotary and battery substation of high voltage, and the energy locally distributed on the three-wire, direct-current system.



FIGS. 1-4.—PROFESSOR ROBB'S PAPER ON ROTARY TRANSFORMERS AND STORAGE BATTERIES.

Electric Railway Construction in Germany.

Of the more important German cities, Aix la Chapelle, Brunswick, Chemnitz, Dresden, Hamburg, Hanover, Leipzig, Munich and Stettin, says United States Consul S. P. Pettit, have almost completely abandoned horse cars and are supplied with electric roads. In the cities of Berlin, Breslau, Cassel, Cologne, Frankfort-on-the-Main, Düsseldorf, Barmen, Elberfeld, Königsberg (East Prussia), and other places, horse lines are being converted into electric roads, and most of these have suburban electric roads completed. A large number of electric lines are being constructed in the country districts about Aix la Chapelle, Bochum, Gelsenkirchen, Düsseldorf, Vohwinkel, Elberfeld, Barmen, Elbthal, Essen, Krais Hoerde, Reisengebirge, Waldenburg (Silesia), Witten-Ruhr, and in the mining districts of the Saar (southern Rheinland) and in Upper Silesia. In 35 cities and districts, not mentioned in the above lists, electric roads were in the course of construction on September 1 last, in nine of which the roads were completed and put into operation before the close of the year; so that, at the beginning of the year 1899, there were 77 cities and districts in the empire supplied with electric roads. In 35 of these places, extensions were being made to the lines in operation September 1, 1898, some of which were completed before January 1.

The following is a comparative statement of electric railway construction in Germany for the past three years:

Description.	August, 1896.	September 1, 1897.	September 1, 1898.	Per cent of increase in 1898 over 1897.
Power-houses.....	42	56	68	21.4
Miles of roads.	362.2	594.7	888.1	21.4
Miles of tracks....	530.7	842.1	1,304.9	43
Motor cars.....	1,571	2,255	3,190	41.5
Trailers.....	589	1,601	2,128	32.9
Electric power, K. W.....	18,560	24 920	33,333	33.8

Adding the roads put in operation since January 1, 1899, it is estimated that there are now 930 miles of electric roads, with a total of 1,300 miles of tracks in Germany. Many American cars are used.

A New Electrical Paper.

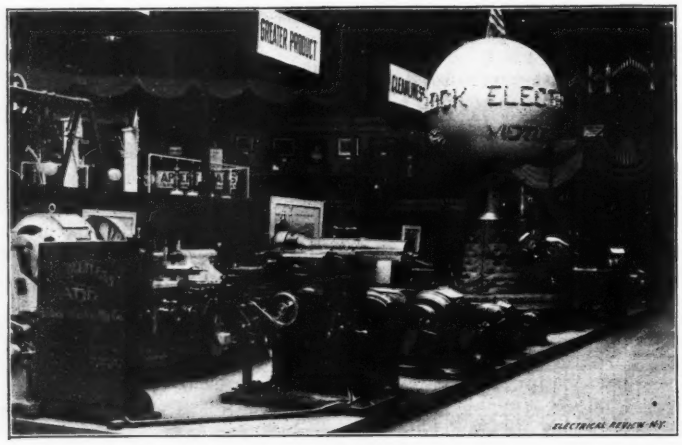
The *Electrical News*, a monthly exponent of electrical industry and finance, has made its appearance. It is published in Boston under the management of Mr. R. F. Ross, a well known pioneer in electrical journalism. The new paper is typographically attractive, and the reading matter is interesting.

Some Attractive Exhibits at the New York Electrical Exhibition.

One of the most attractive exhibits at the electrical show is that of the Bullock Electric Manufacturing Company, Cincinnati, Ohio. This company's specialty is motors for direct coupling to machine tools, etc., and it makes a fine showing of the applications of its motors to such machines, as well as of its dynamos for various purposes. A small vertical, high-speed Forbes engine, direct coupled to a 12-kilowatt dynamo, illustrates the ingenious system of control used by the Bullock company in the distribution of power in machine works, etc. The armature has two windings, connected to separate commutators, and giving respectively 40 and 80 volts. Circuits led from these permit the application to the motors of 40, 80 or, by combining the two, 120 volts. A large lathe and a shaper, furnished with motors, are shown, as well as controllers, open and enclosed motors, back-geared motors, dynamos, etc. One of the unique features of the exhibit is the great revolving silvered globe, carrying the company's name in electric letters. This is turned by an air turbine, and a stream of air, pouring out through a slit in the tubular flagstaff surmounting it, keeps the flag always fluttering. Compressed air for this device is furnished by a small Bullock motor, direct coupled to an American gas furnace blower. The exhibit is in charge of Mr. George Bullock and Mr. R. T. Lozier, the general eastern agent of the company.

A full line of the well known Frink reflectors, adapted to all varieties of electric lighting, is shown in the tastefully arranged booth illustrated herewith. Ceiling lights, shop-window lights, church and office lights, desk fixtures, table fixtures and other sorts of electric light appliances, all embodying the reflector principle, are on exhibition. The 35-inch cluster light, for use in large halls, churches, etc., which is shown at the back of the booth, is especially attractive. The exhibit is in charge of Mr. Frank Stout.

Perhaps no exhibit attracts greater attention from the scientist, the layman interested in useful products and the simple admirer of artistic effects than the exhibit of platinum and its applications, made by Baker & Company, of Newark, N. J.



THE NEW YORK ELECTRICAL EXHIBITION—THE BULLOCK ELECTRIC MANUFACTURING COMPANY'S EXHIBIT.

When pure and in a compact form, this metal is tin white in color; when in a very finely divided state it is dead black. It is not oxidized at any temperature in the air or in steam; it is the heaviest and most infusible metal in commercial use unalloyed; it is nearly as soft as copper and almost as ductile as gold, and, finally, it expands and contracts at practically the same rate as glass, and is for this reason the only metal that can be successfully sealed into glass vacuum apparatus.

In the exhibit mentioned above an excellent opportunity is given the visitor to observe the practical uses made of this metal. In the small space of 10 feet front, artistically decorated in blue and white, within a modest-sized showcase, are exhibited many thousand dollars' worth of platinum in the many forms given to it between the state of crude ore and the finished article of commerce. Samples of crude platinum sand and nuggets from all parts of the world, including the largest nugget ever found in this hemisphere, are shown in an attractive form, together with many specimens of the associated metals of this group, such as iridium, palladium, rhodium, osmiridium, ruthenium and osmium. Grouped about there are many samples of the salts of these metals, exhibiting a beauty and variety of color and crystaline form. There are also many samples of platinum apparatus, such as are used by chemists, dentists, jewelers, electricians and incandescent lamp manufacturers.

An interesting part of the exhibit are four cylindrical rods of pure gold, silver, platinum and aluminum of equal size, which are shown as illustrations of the relative weight and value of these metals.

The gold weighs 10.19 ounces, and is worth $210; the silver weighs 5.55 ounces, and is worth $3.50; the platinum weighs 11.34 ounces, and is worth $196; the aluminum weighs 1.37 ounces, and is worth nine cents.

If one lifts first the platinum rod and then the aluminum, the difference in weight is almost startling.

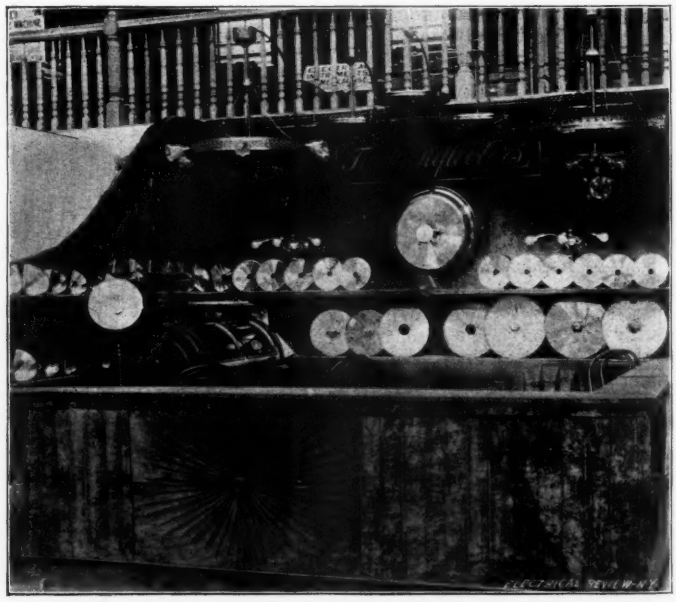
The walls of the booth are adorned with fine illustrations of the photographic art upon platinum paper.

The illustration opposite shows one end of the Columbia Automobile Company's fine exhibit of electric vehicles at the exhibition. Seven vehicles are shown, a brougham, delivery wagon, stanhope, dos à-dos trap, Victoria, hurry-up wagon for electric light companies and an emergency wagon for street-railway service. The latter is one of two recently built for the Consolidated Traction Company, of Pittsburgh, and is a very interesting vehicle on many accounts. Made in the general style of a police patrol-wagon, it is equipped with an extension ladder, a stretcher which can be swung on springs in the vehicle in case it is necessary to use it as an ambulance, Babcock fire extinguishers, and an outfit of wrecking tools, such as is generally used in a street-railway wagon. It is capable of high speeds, and has attracted much attention from street-railway men who have visited the exhibition.

The hurry-up wagon, so-called, is a low-hung vehicle of the runabout pattern, having seats for two persons, and is one of the most attractive-looking vehicles in the exhibit. It is geared for very high speeds, making 18 miles an hour on fairly good streets, and is intended for emergency service or for the use of fire department captains, electric light superintendents, or others who wish to make short and very rapid trips.

The brougham is very handsomely finished in dark green and black. The design of this vehicle is exceedingly pleasing, much of the heaviness noticeable about other automobiles of this type having been eliminated.

One of the most interesting features of the exhibit is the New York Edison company's "hydrant," which is seen at the extreme right of the illustration. This is a cast-iron case resembling a fire plug, which contains a "nickel-in-the-slot" arrangement, whereby an automobile may, upon the payment of the necessary coin, receive a predetermined amount of electric power. It contains, in addition to the usual "nickel in-the-slot" mechanism, a Thomson wattmeter and the terminals for receiving the cord connection from the vehicle.



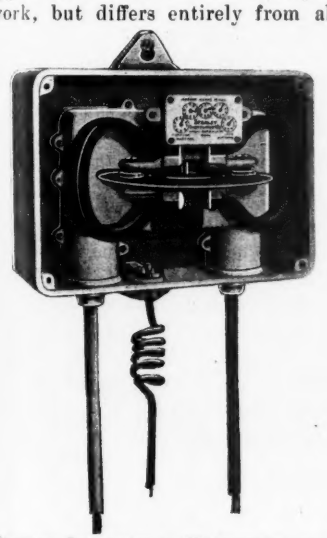
THE NEW YORK ELECTRICAL EXHIBITION—THE EXHIBIT OF I. P. FRINK.

A switchboard of attractive design is also exhibited.

Mr. J. M. Hill and a staff of able assistants have been in charge of this interesting exhibit. Colonel Pope, of Hartford, has also been present a good deal of the time.

THE ELECTRICAL EXHIBITION—THE COLUMBIA AUTOMOBILE COMPANY'S EXHIBIT.

There is shown at the Electrical Exhibition a new type of integrating wattmeter, made by the Stanley Instrument Company, Great Barrington, Mass., which possesses many points of great novelty and interest. The meter is of the induction motor type, well known in this variety of work, but differs entirely from all other meters in that its main shaft is held in no supporting bearings, but is sustained by magnetic attraction solely.

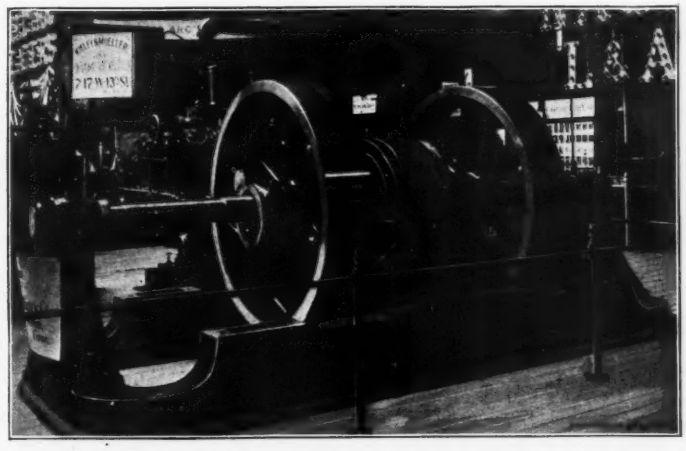


STANLEY INTEGRATING WATTMETER WITH MAGNETIC SUSPENSION.

The moving part of the instrument consists of a thin, circular disk of aluminum, running in a horizontal plane on a short vertical shaft of soft steel. This disk (and the shaft with it) is turned by impulses received from the usual shunt and series coils, and is damped by running between the poles of two horseshoe permanent magnets. These magnets, of the peculiar form shown in the accompanying illustration, are so arranged that a part of their magnetic circuit is completed by the soft steel shaft of the turning disk, in such a way that its weight is exactly counter-balanced by the upward attraction due to the magnet system. At each extremity of this shaft it is turned down to a small spindle, which is hardened. These spindles run through bearing rings, intended simply to keep the shaft vertical. The effect of this arrangement is that all jewels or other end-bearings are dispensed with, the moving part of the apparatus practically floating in the magnetic field, and friction is in this way almost entirely eliminated. A 5,000 wattmeter at the exhibition is shown running upon the current used by an eight-candle-power lamp, or about one-half of one per cent. of its rated capacity. The instrument is direct-reading, and is adapted to stand fairly rough usage on account of the absence of the watch-jewel pivots which distinguish other makes. It is sealed up in an air, moisture and dust-proof case, and is unaffected by external magnetism.

A large tandem compound engine, shown in operation by the Ball & Wood Company, of New York City, is one of the most attractive features of the steam exhibit at Madison Square Garden. This engine, which is 16 inches stroke by 16 and 26 inches diameter in its high and low-pressure cylinders, respectively, is a combination of the Corliss type with certain features of the automatic type, all the release gear of the ordinary Corliss engine having been eliminated from its design. Two wrist-plates connected with two eccentrics operate, respectively, all of the admission and exhaust valves of the two cylinders. These valves are of the usual Corliss quick-opening type, and regulation is secured by a flywheel governor, operating the admission valves in both cylinders simultaneously. By this ingenious construction the advantages of high economy shown by the Corliss engine are added to the ease of regulation and high speed of running possessed by the automatic type. The engine exhibited operates normally at 200 revolutions per minute. Its shaft is extended on each side of the two flywheels for the reception of the armature of a 100-kilowatt dynamo at each end. It indicates 300 horse-power at rated speed. As soon as the exhibition closes it will be mounted in the station of the New Haven, Ct., Electric Light Company. Many visitors have been attracted by the noiseless and smooth running of this large engine, and by the beauty of its valve gear, which is only imperfectly shown in the accompanying illustration.

The Union Pacific Railway has a peculiar task on its hands at its Cheyenne, Wy., shops, where workmen are engaged in straightening 12 miles of surface-bent rails. Last Winter, when the ground was frozen solid, a heavy mountain locomotive that was not counter-balanced was sent over that part of the road at high speed. Every revolution of the drive-wheels struck a powerful blow on the rails, causing them to bend at every revolution. The depression was so great as to give a regular wave-like movement to all trains subsequently passing over the stretch of track.



THE NEW YORK ELECTRICAL EXHIBITION—THE BALL & WOOD COMPANY'S EXHIBIT.

Electric Cab Service for the New York Central Railroad.

George H. Daniels, the general passenger agent of the New York Central & Hudson River Railroad, has determined to establish an electric cab and carriage service at the Grand Central station, in New York city. The plans for the general overhauling of the east wing of the station, and the building of a big train shed, with a large waiting-room for passengers, are to include a charging station and a general repair shop for the electric cabs. The cabs are to be owned and operated by the railroad company. One hundred will probably be installed as soon as the station is completed. It is said that the railroad company has found it impossible to maintain a first-class horse-cab service at the prevailing rates of fare.

Large Order for Aluminum Wire.

It is reported that the Pittsburgh Reduction Company has received an order from the Chicago Northwestern Elevated Railway Company for 150,000 feet of aluminum wire, to be used for feeders on that road. This is said to be the first attempt to use the metal for feed-wire on an electric road, although some has been employed at Niagara Falls and on the Pacific coast in long-distance power lines. The same company is said to be in receipt of other large orders for aluminum from various parts of the country, the copper combine and the further probable advance in the price of the red metal having given a boom to the former.

The total length of electric railways in Switzerland is 105 miles, of which 47 miles were opened last year. The power for nearly one-half of the lines is obtained from waterfalls.

A Visit to the Works of the General Electric Company, at Schenectady.

On Friday, May 26, the National Electric Light Association visited in a body the extensive works of the General Electric Company, at Schenectady, N. Y. A special train of seven Wagner palace parlor cars were provided, and the party of nearly 200 left the Grand Central depot at 8.35 A. M., and arrived at Schenectady about noon. Returning, the party left about 7.30 in the evening, and arrived in New York shortly before midnight. A number of ladies accompanied the party and were taken in charge by a committee of ladies at Schenectady, and participated in a very agreeable drive while the gentlemen inspected the mammoth works. The entire train was side-tracked among the buildings, and so extensive are the works that it was lost to sight, and at times many of the visitors found it difficult to locate. The numerous buildings were thrown open, and the party was taken through under intelligent guidance from the staff of the company, various interesting operations being explained in detail. President C. A. Coffin, Vice-president Eugene Griffin, General Manager S. Dana Greene, Treasurer H. W. Darling, Mr. S. M. Hamill, and other officials of the company accompanied the visitors in person. The first three gentlemen went with the special train from New York, as did also Mr. E. H. Mullin who arranged the details and managed so successfully the elaborate train service and dining arrangement. Mr. A. L. Rohrer, at the works, perfected the plan of the inspection so that all departments were seen easily and comfortably. Every visitor was greatly impressed with the magnitude of the works and the exceedingly busy appearance of every department.

At 5.30 an elaborate electrically-cooked dinner was served in the gallery of the new machinery building, which is so vast that, although over 200 persons were served at the tables, they only occupied a small corner of the gallery of this immense building. This is an impressive fact, and will give one an idea of the magnitude of the newer buildings of the company now nearing completion.

President Coffin presided at the dinner, and welcomed the visitors in particularly timely and appropriate words, admitting that much of the progress of the General Electric Company was due to the suggestions and intelligence of the electric light men of the country. The newly elected president of the association, Gen. S. T. Carnes, answered in behalf of the association, and fittingly extended the thanks of all the visitors for the excellent entertainment and very interesting exhibition they had seen of practical electrical manufacturing. The Mayor of the city also said a few words of welcome. Mr. Coffin feelingly alluded to the death of Mr. Kruesi, who had a personal friend in nearly every electrical man present, and a toast to this able and popular official was drunk standing and in silence.

Before leaving the tables a vote of thanks and three rousing cheers were given for the General Electric Company, its president and other officers. After gracefully acknowledging the presence of the ladies, Mr. Coffin adjourned the meeting in time for all to get on board the train and return tired, but happy, to New York city.

On the way to the works, pamphlets illustrating and describing the works of the General Electric Company were distributed through the train, and were of much assistance to the visitors in passing through the buildings.

Between 6,000 and 7,000 employés are now on the pay-rolls of this company at Schenectady, and new buildings are being constantly built. The immense newly-finished foundry, which was noted in these columns a few weeks ago, and which was thought at the time the building was commenced would be much too large, is already full to overflowing, and plans are being made for additional room.

The Automobile Club of New York.

The owners of private automobile vehicles in the city of New York are organizing the Automobile Club. The moving spirit of the proposed club is Mr. Whitney Lyon. Messrs. E. H. Lyon, A. L. Riker, A. Whitney and G. F. Chamberlin are also deeply interested in the scheme. The club expects to start with a membership of 100. The proposed plans include a club house located in the center of the residence portion of the city, where members can meet and where the automobiles can be stored and recharged.

Mr. George G. Ward, vice-president and general manager of the Commercial Cable Company, sailed recently for Cologne, to consult with the German Atlantic Telegraph Company, on the question of the new cable between Germany and the United States by way of the Azores Islands.

A Dinner at Delmonico's.

Among the several enjoyable social events occurring in New York during the convention of the National Electric Light Association none was more highly enjoyed than the dinner given by Dr. W. M. Habirshaw at Delmonico's, Tuesday evening, May 23. The dinner was as elaborate and tasteful as the resources of this famous house could supply, under the special guidance of the host, and the guests included gentlemen prominent in electric lighting circles, all of whom were close friends of Dr. Habirshaw and acquainted with each other. Probably a more congenial party of electrical spirits was never gathered around a dining table. There were some eighteen present, among them being President A. M. Young, of the National Electric Light Association; ex President Charles R. Huntley, and Messrs. F. J. Sprague, C. L. Edgar, J. W. Lieb, F. A. Gilbert, Martin Insull, T. C. Martin, Charles W. Price, L. B. Stillwell, L. A. Ferguson, E. A. Leslie, George Urban, Jr. Ex-President Samuel Insull was expected to be present, but as that was the evening of his marriage, his excuse when brought by his brother, Mr. Martin Insull, was voted a good one, and at the suggestion of Dr. Habirshaw, a toast was drunk to the bride and groom. A number of informal little speeches were made and the pleasant party separated at a late hour and will ever remember the delightful evening.

The Phœnix Battery Manufacturing Company.

The organization of the Phœnix Battery Manufacturing Company, of St. Louis, Mo., has been recently completed with a paid-up capital of $250,000. As recently announced in the ELECTRICAL REVIEW, this company will devote its entire time exclusively to the manufacture of galvanic batteries, carbon specialties and battery parts. An eight-acre tract of land in the city of St. Louis has just been secured, and a large plant will be built and equipped. The manufacture of carbon batteries and parts requires skill, great care and close attention in all the details of manufacture. The demand of the trade is for the best, and recent inventions and improvements in batteries give the Phœnix Battery Manufacturing Company an especially strong position in this field. The company has prepared to do business on a large scale, and is fortunate in having as its superintendent, Col. S. G. Booker, a pioneer in the carbon business and a gentleman well and popularly known in the electrical field.

PERSONAL.

Mr. George A. Redman, of the Rochester Gas and Electric Company, Rochester, N. Y., visited New York city last week.

Mr. Frank G. Bolles has resigned his position as advertising designer and writer of special literature for the Westinghouse Electric and Manufacturing Company, and has accepted the management of the advertising department of the Bullock Electric Manufacturing Company, of Cincinnati.

Messrs. H. H. Vreeland, president, and W. H. Starrett, electrical engineer, of the Metropolitan Street Railway Company, of New York, visited Chicago last week. It is rumored that Mr. Vreeland may assume the management of the Yerkes street railways in Chicago, in addition to his duties in New York.

Mr. George R. Metcalfe has been appointed associate editor of the *Street Railway Review* and removed to Chicago last week. Mr. Metcalfe was associated with Mr. B. E. Greene in the conduct of *Electricity* when that paper was a factor in the field. He is a well trained newspaper man, and we congratulate our contemporary on securing his services.

President Clinton L. Rossiter, of the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., returned from Europe on May 30 in the "Kaiser Wilhelm der Grosse," after an absence of about a month. Friends of Mr. Rossiter sent to the "Kaiser Wilhelm der Grosse" an immense floral piece in the shape of a trolley car with the words "Flatbush Avenue" in white flowers on the sides.

Mr. Pierre Otis Keilholtz has been appointed general manager of the United Electric Light and Power Company, of Baltimore. Mr. Keilholtz is at present chief engineer of the United Railways and Electric Company, and will continue to discharge those duties. He was graduated from the Naval Academy at Annapolis in 1884, and took a post-graduate course at the Johns Hopkins University from 1884 to 1886. He then entered the service of the Brush Electric Light Company and later went with the United States Electric Company as superintendent and secretary. Mr. Keilholtz was electrical and mechanical engineer of the City and Suburban Railway, and held a similar position with the Consolidated Railway Company. He was appointed chief engineer of the United Railways and Electric Company when the company was formed in March.

A Model All-Round Electrical House.

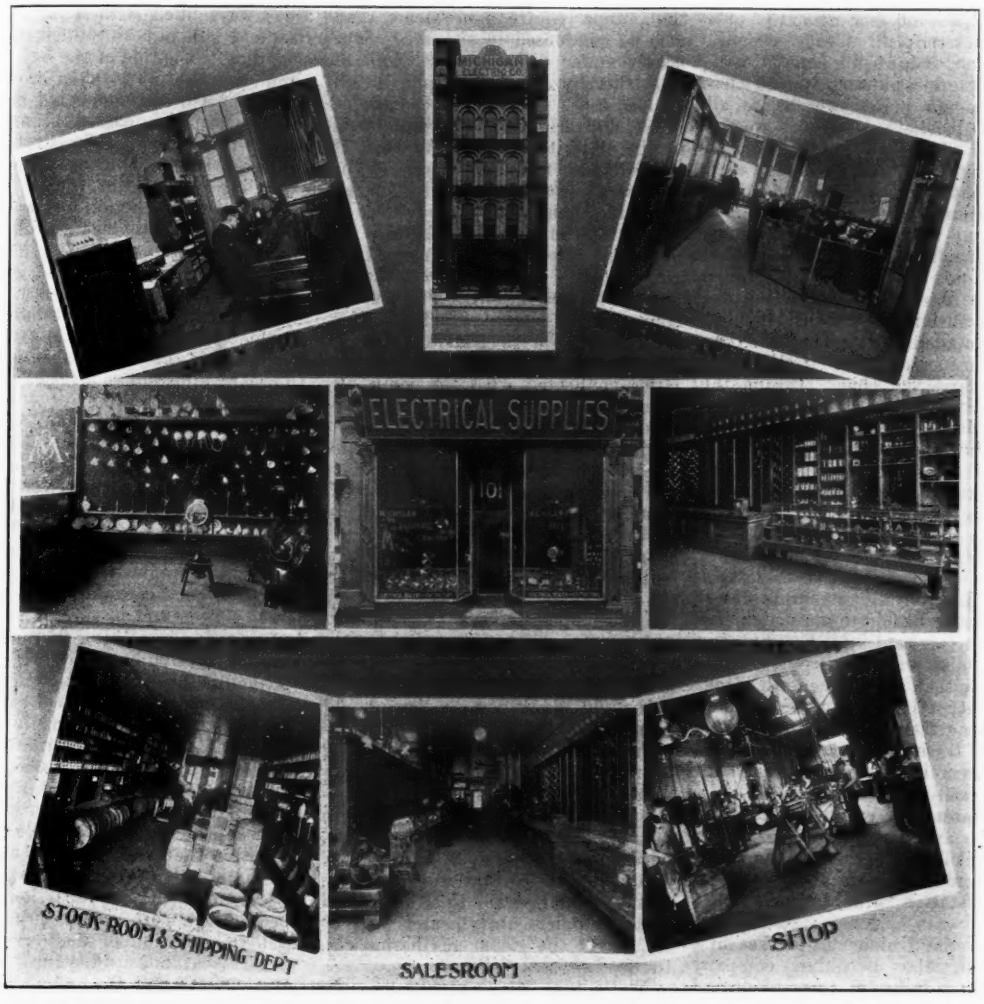
The Michigan Electric Company, whose new quarters in the city of Detroit are illustrated herewith, began business March 1, 1893, as electrical contractors for wiring and general construction, with an office in the Hammond Building. Business grew rapidly from the start, and they soon were obliged to move to larger quarters, where they soon after added a small stock of wire and electrical supplies. The business continuing to grow, they again moved to still larger quarters, and soon after doubled these, the added accommodations sufficing for the following year's growth only. In April, 1896, three years after their start, they leased and moved into the four-story and basement brick building at 101 Woodward avenue, in the finest retail section of Detroit, as they believed the electrical business deserved as good location and quarters as any of the older lines of trade.

September 24, 1898, they were almost completely burned out by a fire of unknown origin, but, undaunted, rented temporary quarters opposite the old location while the fire was still burning, and before the crowd had dispersed, with electrical promptness, they had temporary signs up, telephone in, and resumed business. Fortunately the fire did not destroy any valuable records, so they immediately made out such a complete statement of their loss as enabled them to reach a settlement with the fire insurance companies the same day the statement was presented. This fact alone evidences their thorough and able management of business affairs.

The rebuilding of their old quarters having next been arranged for, President Joseph E. Lockwood visited the leading wholesale and retail electrical and hardware houses of the country and studied in detail their arrangements, fixtures and methods with a view to securing in their new quarters the best possible combination to meet the requirements of their business and utilize to the fullest possibility the space available.

December 10, 1898 (less than 90 days after their fire), they moved back to their old location, which meanwhile had been entirely rebuilt from the ground up, excepting only the bare walls, and to-day they have one of the most handsome and most convenient premises of any all-round electrical house in the country.

Their business now covers everything in the electrical line, including electrical supplies and machinery, wholesale and retail, repairing electrical machinery and appliances, contracting for anything from installing a bell job on time and material to furnishing and installing complete plants for light, power and railways, and in addition they have an experienced engineering force competent to handle every class of electrical work. They are manufacturers' agents for many of the leading electric specialties, such as Cutter switches, Western electric fan motors, Atkinson's protected rail bonds, Creaghead overhead material and brackets, chloride accumulators, Edison incandescent lamps, etc., and for very large contracts represent the well known firm of J. G. White & Company, of New York. They also are themselves manufacturers of electric and combination fixtures, from both standard and special designs, of electric signs and decorative devices and other specialties.



VIEWS OF THE MICHIGAN ELECTRIC COMPANY'S NEW ELECTRICAL SUPPLY HOUSE AT DETROIT, MICH.

The supply department occupies the first and third floors and basement; on the first floor is the general salesroom and supply department office. This salesroom is strikingly attractive, the fixtures being of oak, in handsome and uniform design, arranged to display electrical samples of every description for both appearance and convenience. The show-windows in front of this floor make a handsome appearance from the street, and as the windows are freshly dressed every week, they always attract much favorable attention.

The third floor is the receiving and shipping room, and also provides space for part of the reserve stock. It is connected with all other floors by two power elevators (one passenger and one freight), and by a Sargeant hand-power, package elevator, as well as by telephones and speaking-tubes.

The basement provides space for additional reserve stock and for tools of the construction department.

On the second floor are located the company's general offices, the heads of all departments (except supplies) being located there, but kept in touch with other floors and outside trade by means of a complete telephone system.

On the fourth floor is located the machine-shop, which, with its plating, polishing, stock and tool-rooms, is a complete factory in itself. Every part of this floor is utilized to the fullest advantage, the lighting from front, rear and skylights being very complete.

This company has a large force of employés and a business of such wide scope that naturally it requires special arrangements and handling to conduct it successfully; but its business divided into departments, each headed with an able and experienced man—the whole under the sole direction of the president—everything is conducted as simply and successfully as though one line only were followed.

This firm believes that the bulk of the business of the country will not be secured by any one or two large centers of trade, but that it will be divided into natural sections, in each of which the greater part of the business will go to whichever house is the best located and adapted to meet its needs promptly and satisfactorily, and believing this, has confined its efforts to, and sought to provide for, the needs of its section chiefly. The steady and rapid growth of its business during the depressed business period now practically passed is, it thinks, indisputable evidence of the correctness of its belief. With quarters unexcelled by any one in their line in the country, with facilities and experience suited to electrical business of every description, and with general business conditions indicating the coming of an era of great prosperity, this company—of which Mr. J. G. Lockwood is president and Mr. Geo. A. Mansfield is vice-president—has every reason to feel that, great as has been its success in the past, the future promises a still greater one.

A LOCAL TRANSMISSION SYSTEM—DEVELOPMENT AND OPERATION.

BY W. S. BARSTOW.*

(Continued from page 330.)

The First District substation distributes 800 kilowatts of direct current to an Edison underground system.

The Second District substation distributes 400 kilowatts of direct current to an Edison underground system.

The Third District substation distributes 400 kilowatts of direct current to an Edison underground system.

The Municipal substation, when transformed and completed, will distribute energy for 1,700 direct-current series arcs and will have 500-kilowatt capacity of three-phase, 60-cycle, alternating.

When it is appreciated that this entire number of substations, each supplying a territory about one and one-half miles in diameter and covering an area of 120 square miles, is supplied by one station, and often from one large generator, the simplicity of the generating system can be easily seen.

The First and Third District substations are what may be termed "peak" plants, in that the original steam plants are still used during the "peak" hours, thus leaving on the main station a load that is practically uniform during the 24 hours—in fact, possessing a load-factor, six days per week, of over 90 per cent.

Such a generating and distributing system possesses not only great engineering advantages, but is a means whereby the highest load-factor can be secured. Several stations operating distinctly non-interchangeable systems can never reach the minimum cost in the production of energy. One station operating a universal system, or even two stations operating universal interchangeable systems, at once have at their disposal means for developing economies.

During the operation of the three-phase system in Brooklyn, admirable chance has been given for testing the practical value of the load-factor. At one time 2,000 horse-power was shifted to and from the Union station from two of the large direct-current stations in such a way that for each of two days the total generated kilowatts of the Union station remained exactly the same; but the load-factor during one of the days was 25 per cent and during the other 80 per cent. Careful record was then kept of the cost of generation during the 24 hours of these two days in the Union station. It was found that when the load-factor of the station was 80 per cent the cost was decreased 70 per cent over what it was when the load-factor was 25 per cent, the total kilowatt-hours of each of the two days being exactly the same.

With a view of keeping continuous records of the detail performance of the system, a complete line of recording wattmeters was provided for. At the Union station each generator output is metered; all energy used in the station, comprising energy supplied to pumps, blowers and auxiliaries to steam plant, which are all electric; all energy supplied to the generator fields; all energy used in station lighting; and all energy used in coal handling, operation of crane, etc., is metered. It was found necessary to put wattmeters on both ends of the feeders leaving the Union station and leading to substations, with the object of ascertaining the loss in transmission, because the loss in transmission is often not more than the error in the meter itself; i. e., two or three per cent. Taking the energy used in the station from the energy generated at the machines gives the energy delivered to the feeders. This energy is metered to the different substations. Each substation output is metered in whatever form the energy is distributed to the customer. This last set of reading, plus the average loss of each substation distributing system, is designated "current sold to the customer," and upon this reading is based all the cost of distributed energy. Thus, it can be seen that the energy, from the point of generation to the point of entering the customer's meter, can be kept trace of, step by step, and the commercial efficiency of each substation easily determined.

As almost every engineer is familiar with the average type of generating station, it is only necessary to mention here a few of the points in which the Union station differs from other plants.

When the Union station was first discussed, the Brooklyn company made every endeavor to weed out all details that tended to poor economy, and thus start the system with a modern, up-to-date generating plant. Among the various items was discussed the question of station auxiliaries. As a result of these investigations the Union station was designed and equipped with all auxiliaries electrically operated, the steam from the boilers being used only in the main engines.

There is often brought forward the question as to whether the loss in feed-water temperature, etc., will not more than balance the high efficiency of the electric auxiliary. Owing to the fact that it is impossible to find two plants of equal size operating under similar conditions, an exact actual general comparison between steam and electric auxiliaries is difficult to obtain. The ideal conditions of a steam auxiliary in regard to efficiency would be: First, no loss of radiation from supply piping or the device itself; second, sufficient waste exhaust to be entirely condensed in a supplementary heater at all station loads; and, third, the replacing of such condensed exhaust back in the boiler. Under these ideal conditions all heat units of the exhaust of the auxiliary could be recovered, and such a system would be perfection. In the ordinary central station we find that the radiation of supply piping and the pumps themselves involve a loss of 25 per cent, and that the pumps require more steam than can be condensed in the feed-water heater under different conditions of load, thereby allowing surplus steam or heat units to escape to the atmosphere, and also that it is impractical in the majority of cases to return to the boiler the steam condensed by the feed-water heater, owing to the presence of oil, and that the methods of separating the oil from such water are naturally slow and in themselves involve a loss of heat or expenditure of energy. Thus the entire problem becomes one of actual practice rather than theory. With electric auxiliaries driven from the main engine, or auxiliaries connected with the main engine, the economy of the auxiliary is very nearly the economy of the main engine itself. In other words, the electric auxiliary can develop a horse-power on the shaft of the pump with about 18 pounds of steam, including losses. This is about one-fifth of the energy required by a steam auxiliary best suited to the conditions; but, on the other hand, the electric auxiliary returns no energy back to the plant, and a certain allowance must be made for the loss in feed-water temperature. In considering the two systems in any individual plant, comparisons should be made both with systems using economizers and exhaust heaters, one using supplementary heater with steam auxiliaries and the other electric auxiliaries without supplementary heater. In many cases the highest efficiency can, no doubt, be secured by using a few steam auxiliaries that would furnish just sufficient steam to be condensed in the supplementary heater, varying the use of the steam auxiliaries with the load.

The actual energy required by the electric auxiliaries at the Union station, with a load of 2,732 indicated horse-power on the main engine, is as follows:

	Electric horse-power.		Per cent.
Air pumps on surface condensers	11.6	or	.42
Circulating pumps on surface condensers	14.4	"	.53
Boiler feed-pumps	23.6	"	.87
Total of main auxiliaries	49.6		1.82

Reducing this to indicated horse-power at main engine, 66.8 indicated horse-power, or 2.45 per cent of the total steam used in the station.

In addition to reducing to a minimum the energy required by the station auxiliaries under ordinary conditions, the building was so constructed as to alter somewhat the conditions and reduce to a considerable extent the amount of work itself which the auxiliaries were to accomplish. This applied particularly to the method of circulating the water for the surface condensers. Two large tunnels, each 12 feet high and 8 feet wide, were constructed, side by side, beneath the entire foundations of the building, with their openings below the mean tide level and extending out into the bay. These tunnels, constructed of heavy masonry and extending directly beneath the large surface condensers, are always filled with water, which rises and falls in both tunnels equally, according to the tide of the bay. The circulating water is taken from one tunnel by a direct-connected electric centrifugal pump, passed through the surface condenser and discharged into the other tunnel, the discharge pipe extending below the lowest water level. This construction forms a water loop in which both legs are of equal length, and in which loop are located centrifugal pump and surface condenser. Thus, when the water is once started, the columns balance one another, so that very little power is required by the centrifugal pumps. In order to prevent an air pocket from forming and breaking at intervals the discharge column, an air-pipe connection is carried from the top of the discharge opening in the condenser to the air pump, a very slight turn of the valve sufficing to keep all of the air out of the system. Whereas, under ordinary conditions, about 26 horse-power would be required, under these new conditions but seven horse-power is necessary to circulate water sufficient for furnishing 26 inches of vacuum to 1 500 horse-power.

Among the auxiliaries might be classed the generator field-exciters. The question of economically exciting the fields of large alternators has been one which has often been overlooked to a large extent as a matter of small importance. Exciters directly connected to the shaft of the engine operating the alternator, or belted to the same shaft, have introduced more or less trouble, as any variation in the speed of the main engine produces a cycle in variation of field regulation which is at once disastrous to the good operation of the system. After carefully studying the subject, the following plan was adopted in the Brooklyn installation:

A high-tension, synchronous motor, directly connected to a low-tension, direct-current generator, is directly connected to the bus-bars of the station, to which are connected the main alternators. The low-tension, direct-current generator, connected in multiple with a small regulating storage battery, excites the fields. Should the voltage on the main system vary to a greater or less extent, no variation occurs in the voltage of the field excitation, since the synchronous motor which depends for its speed on the speed of the main generator, and not on the voltage, supplies power to the direct-current exciter. Should the speed of the engine vary to any extent the

* A paper read before the National Electric Light Association, New York, May 23, 1899.

battery acts as a regulator. The battery also is of such a capacity that the entire exciting set can be shut down for one hour without any variation in the exciting voltage, the battery automatically discharging. If, in place of a synchronous motor set, a rotary transformer were used, the result would be somewhat unsatisfactory, since a variation in voltage, as well as speed on the main generator, would affect the field current. Of course, belted or direct-connected exciters can be used with the battery with equally good economical results, but independently operated exciters furnish a more flexible system.

In the designing of a switchboard for high-pressure work special attention should be paid to the simplicity of arrangement and contents of such board, as the fewer the devices, the better for the reliabilty and success of the system. The conditions of the operation of a high-tension multiphase system, when used for distributing purposes to substations, differ considerably from the requirements of a primary station with a simple distributing system. This difference lies mainly in the fact that feeder regulation in the high-tension multiphase transmission system can be almost entirely dispensed with, the substations doing the necessary regulating for the energy as required by the customers. Therefore, the important requirement in the multiphase transmission station becomes simply the positive controlling of the energy generated at the machines, with possibly the operating of one or two sets of auxiliary bus bars. For the controlling of this generated energy, switches, capable of breaking a full and overload current, should be placed between the gener ators and the bus-bars, and between each set of bus-bars This requirement will be found to be imperative. In Brooklyn these switches are operated by electrically controlled pneumatic attachment, used by the Pennsylvania Railroad system in their large switch yards. In all cases these have been positive and satisfactory in action. It is the present intention to control the interlocking circuit by a device dependent upon the synchronizing of the current, so that two machines or sets of bus-bars can not in any way be accidentally connected when out of phase. The switch itself, breaking under oil, is not in any way complicated, and has satisfactorily withstood the test of capacity and time. These main switches, placed as above stated, are the only ones in the station which will break under overload and pressure of 7,000 volts, with the exception of the emergency switches. These emergency switches are plain, pivoted, copper blades, with a fuse in multiple, and are to be pulled only in a case of last resort in event of any accident happening to the switchboard itself. As before stated, the controlling of the feeder load from the transmitting station is not an actual requirement in the multiphase system with substations, as the load can more easily be controlled at the substation, and therefore the high-tension feeder switch can consist of a simple pivoted copper blade placed between the bus bars and the fuse block.

The multipling of large alternators has always proved an attractive subject. The parallel operation of small, belted, high-speed alternators has been accomplished from the beginning of alternating-current history. Even under these simple load conditions, however, it was often found inadvisable to operate in multiple longer than was necessary to transfer the load. At the present time, however, the alternating system having passed its one-machine limit, it becomes a commercial necessity to operate continuously in multiple.

The paralleling of alternators depends primarily upon the prime mover and character of apparatus employed in the distributing system. Hitherto, the selection of a single, two or three-crank engine has been a matter of choice depending upon space, economy, first cost, etc. Having selected, based upon these items, a particular type of engine, the requirements of the generator and multiple operation has been accomplished by the simple addition of a flywheel. If, after obtaining by this flywheel method a prime mover with a variation in angular velocity of about one-fourth of one per cent, a direct-connected generator with a constant load is added, and the set properly operated, no fluctuating or noticeable disturbance is evident; but should a second unit, constructed exactly similar to the first and with an equal weight of flywheel, be thrown into parallel, there is often noticeable a pumping effect or cross current, which seriously interferes with the operation of the distributing system. Even if two steam units were built from the same set of patterns, and were operated at the same steam pressure, it would never be possible to keep a fixed point on one exactly opposite a fixed point on the other for any long period of time, so that, in order to keep these fixed points together, a certain amount of energy must be expended by the generators. Thus the generators, having once been thrown into step, are called upon to make up in electrical energy all the differences in speed-changing tendencies of the two prime movers. This effort on the part of the generators themselves to balance up the unequal momentum of flywheels, and store up and liberate energy, is represented by actual horse-power, shown in heavy cross currents alternately swinging from one generator to the other. This energy, we might say, is not apparent as a total, since it is first on one unit and then on the other; but it nevertheless exists, and, under certain conditions, may detract from the useful capacity of the generator itself. If, in the choice of the type of engine, there should be considered the question of variation in angular velocity as accomplished by the number of cranks, so that it might be possible to use a lighter flywheel, a point in the weight of the flywheel can be reached where, in comparison with the frequency of the alternator, a minimum synchronizing power is required. This is by far the preferable solution of the difficulty, and, in fact, will be a requirement where the frequency is fairly high (about sixty cycles), and the speed low (about seventy-five revolutions.)

All cross currents generally emanate from one of two sources: First, they may be wattless, showing the transferring of current not real energy, which, while not affecting the system, will heat up the generators. This shows a poor adjustment of fields, which, to obtain the best result, should be so regulated as to give a slightly leading or lagging current, leading in all cases preferred. Second, they may be watts, showing the transferring of real energy or horse-power, which will affect the system, besides heating up the generators. This shows a poor design or adjustment of the prime mover in regard to variation in angular velocity, sometimes even caused by the engine designer using too heavy a flywheel—a flywheel which will be more than enough to give a minimum variation in angular velocity. In other words, there exists a certain synchronous relation between the speed, the momentum of the flywheel and the load, and a hunting is sure to result if the correct relations are not observed.

The influences of a synchronous load upon multiple operated generators is a question of very great importance. Under certain conditions generators can be operated in multiple with perfect results on a steady static or non-inductive load, but when to the system is added a large proportion of synchronous motors and rotary transformers, poor results often occur. The swinging or cross-current effects, which are entirely absent on two well-designed units operated in multiple, often appear to a very great extent when synchronous apparatus is used on the system. Such effect is noticed by a hunting or pumping due to the moving masses of the synchronous apparatus not acting in unison with the frequency or main generator; or, in other words, again a case of non-synchronism of moving masses. By giving the synchronous apparatus a slightly leading current this can be reduced to a minimum. In other words, an alternating system with synchronous apparatus operated at highest power factor is in a continual state of unstable equilibrium or see-saw, and any equalities of movement of any of the moving masses, whether on prime mover or transforming apparatus, tends to disturb the system to a greater or less extent.

After once obtaining a satisfactory prime mover, with properly proportioned flywheel, cranks, etc., the question of controlling and distributing the load on multiple-operated units must be considered. It is best that the governors of all engines should be sensitive as applied to full and no-load regulation, as thereby a constant frequency is secured, but that these same governors should be sluggish when it is necessary to take care of any sudden variation in speed, so as not to cause a variation in angular velocity. The controlling of the governor to the extent of the difference in speed between no load, full and overload should be in the hands of the electrical gallery operator, as by the independent controlling of the speed of the engine the load should be adjusted on the different units. Such an independent regulating device can easily be attached to any type of governor, and may be either hydraulic, pneumatic or electrical controlled.

Distribution from a high-tension multiphase plant is an important problem, particularly as regards the underground and overhead conductor systems. In Brooklyn, with a view of securing the best service on feeders, which must necessarily be overhead, heavy chestnut poles of about 45 to 50 feet in height, and about 90 feet apart, were used. The poles are fitted with special six-pin cross-arms. On the outside insulators of the top cross-arm are attached barbed galvanized-iron wires, which are grounded at every fourth pole. The second cross-arm carries the feeders in duplicate, three on each side of the pole. With three conductors on a horizontal cross-arm, we are able to reduce inductive effects by transpositions, which, at low frequency, are satisfactory. The insulators are of glass, of the double or triple-petticoat type, and during the two years they have been in use, no defects whatever have developed. The line is carried entirely over all obstructions, in some cases it being necessary to use 70-foot poles. More or less trouble has been experienced with lightning, and the heaviest trunk lines have been equipped with lightning arresters.

(To be continued.)

The John A. Roebling's Sons Company Incorporated in New York State.

The John A. Roebling's Sons Company, of New York, was incorporated at Albany, N. Y., on May 25, with a capital of $100,000, to manufacture and deal in wire, wire rope, iron, steel, copper and all other metals and other materials used in connection with them, and to contract for building structures of such material and metals. The directors are: Washington A. Roebling, Charles G. Roebling, Jr., Frank O. Briggs, Charles G. Roebling and Ferdinand W. Roebling, of Trenton, N. J., and Henry L. Shippy and Edmund Roebling, of New York city.

The company is controlled by the same people as the original New Jersey corporation, the company having been incorporated in New York state for convenience in doing business and to avoid the disadvantages attached to a foreign corporation.

ADVANCE INFORMATION

New Telephone and Telegraph Companies.

SPARTA, ILL.—The Sparta Telephone Company has been incorporated; capital stock, $5,000; incorporators, James Sproul, Jr., A. B. Sproul and Matt Sproul.

SAN FRANCISCO, CAL.—The Western Automatic Telephone Exchange has been incorporated; capital, $25,000; incorporators, Scott Calhoun, Andrew White, John H. Mitteo, A. C. Aiken, all of San Francisco; Archie Borland, Oakland.

AVON, ILL.—The North Fulton Telephone Company has been incorporated; capital, $1,500; incorporators, A. E. Hatch, F. E. Woods, H. F. Townsend.

ATKINSON, ILL. — The Henry County Telephone Company has been incorporated; capital, $2,500; incorporators, W. D. Colby, W. H. Cosner, Isaac Pyle.

STERLING CENTER, MINN.—The Sterling-Amboy Telephone Company has been incorporated; capital, $10,000; incorporators, L. W. Wells, W. Wells, C. H. Brace, William Ellis, all of Sterling Center; C. L. Louer, J. E. Morrill, M. D.; Chas. Thompson, all of Amboy.

MONTEVIDEO, MINN.—The Citizens' Telephone Exchange has been incorporated; capital, $25,000; incorporators, R. D. Zimbeck, Ole Johnsrud, James Bridges, A. C. Anderson, L. E. Miller, all of Montevideo, and 23 others.

DOYLESTOWN, OHIO—The Doylestown Telephone Company has been incorporated; capital, $5,000; incorporators, B. F. Pritt, S. H. Miller, W. H. Huffman, J. M. Dague, O. E. Stepfield, all of Doylestown.

FRANKFORT, KY. — The Green River Telephone Company, of Owensboro, has been incorporated with the Secretary of State; capital stock, $5,000.

CAMPBELLSVILLE, KY. — W. W. Ingram is at the head of a movement to build a telephone line from this place to Pitman via Bengal and other points in the western part of Taylor County.

LESLIE, MICH.—The Leslie Telephone Exchange has been incorporated; capital, $25,000; incorporators, V. H. Grout, W. G. Stewart, W. F. Prescott, all of Leslie.

LESUEUR, MINN. — The Lesueur Telephone Company has been incorporated; capital, $10,000; incorporators, H. F. Weis, J. McKasy, M. W. Grimes, all of Lesueur, Minn.

HUNTSVILLE, TEX.—The long-distance telephone is preparing to build into Huntsville from Phelps right away.

LEDERACHVILLE, PA.—The Keystone Telephone Company will extend its line from this place to Salfordville, Woxall, Sumneytown, Green Lane and Pennsburg.

CHATSWORTH, ILL —The Peoria & Eastern Automatic Telephone Company has been incorporated; capital, $12,000; incorporators, F. C. Stanford, Joseph E. Heald, G. W. McCabe.

VAN WERT, OHIO—The People's Mutual Telephone Company has been incorporated, with a capital stock of $10,000. The incorporators are S. S. Tuttle, H. V. Allen, T. A. Ruegsegger and others.

MACHIAS, ME.—The New England Telegraph and Telephone Company has completed additional circuits between this place and Eastport and Machias and Calais. This company will probably extend its lines to Deer Isle this Summer.

YANKTON, NEB.—The Milling, Power and Light Company, with a capital of $20,000, has been incorporated; incorporators, William J. Pugh, J. H. Vail and J. B. Welo.

GOLCONDA, CAL.—The Pope Telephone Company has been incorporated; capital stock, $5,160; incorporated by Edward B. Clark, Will H. Moore and John O. Williamson.

BALTIMORE, MD.—The Maryland Telephone Company has been permanently organized with Mr. George R. Webb, president; Mr. Harry A. Parr, vice-president; Mr. Pinkney W. Wilkinson, secretary; and Mr. William H. Emory, treasurer, with the directory composed of Messrs. Parr, Webb, John Waters, William L. Marbury, Seymour Mandelbaum, James Bond, Frank A. Furst, Chas. T. Westcott, William H. Bosley, Carroll T. Bond, John T. Stone and Jesse Slingluff.

New Electric Railways.

OXFORD, MICH.—C. L. Randall, W. J. Lunstead and C. E. Stanton, of this place, have petitioned the township board for right of way for an electric line from Orion to Oxford and on to Oakwood; the line to connect with the Detroit line at Orion.

READING, PA. - The Kutztown & Fleetwood Railway Company has been organized, and application will be made for a charter. The road will be another link in the proposed system of electric railways between this city and Allentown.

PHILADELPHIA, PA.—A charter has been issued by the State Department at Harrisburg to the Lancaster, Mechanicsburg & New Holland Railway Company to build an electric line 12 miles long in Lancaster County. The company is capitalized at $150,000, and its president is William B. Given, of Columbia.

JEFFERSON, OHIO — The Burton, Jefferson & Andover Electric Railway Company has been incorporated; capital stock, $10,000.

ALBANY, N. Y.—The Coxsackie & Greenville Traction Company have filed papers of consolidation with the Secretary of State. The capital is $200,000. The new corporation is a combination of the Greene County Traction Company and the Greenville Traction Company.

POTTSVILLE, PA.—The Pottsville Union Traction Company, with a capital of $100,000, has been incorporated; R. Steen Martin, John W. Emery, Norman A. Taylor, P. Barre and John G. McPherson, all of Philadelphia, corporators. The consolidation will embrace the following trolley lines: Schuylkill Electric, Palo Alto & Port Carbon, Pottsville & Reading, operating from Pottsville to Schuylkill Haven; Schuylkill Haven & Orwigsburg, operating between those two towns, and the Tamaquay & Pottsville, from Port Carbon to St. Clair.

MILFORD, MASS.—The Grafton, Upton & Milford Street Railway Company has been incorporated; president, Louis B. Whieldon; vice-president, A. A. Jenkins; directors, William G. Whieldon, Abbot A. Jenkins, Louis B. Whieldon, John F. Simmons, Stephen B. Fiske; general manager, Louis B. Whieldon.

ADAIRSVILLE, GA. — There has been some talk of an electric line being run from here to Fairmount, Ga., a distance of some 20 miles New York capitalists have the matter under consideration.

PROVIDENCE, R. I.—A bill has been introduced in the Rhode Island Legislature incorporating the Rhode Island Suburban Railroad Company, with $2,500,000 capital stock, to construct, maintain and operate railways other than steam, in Kent, Washington, Providence and Bristol counties. The corporation expects to obtain from the United Traction and Electric Company rights acquired by that company in the Warwick & Oakdale Beach branch of the New York, New Haven & Hartford Railway Company, and operate this road, with branches to East Greenwich and other places. It has also obtained rights of construction and maintenance on the other shore of the bay. The incorporators named are Albert T. Potter, general manager; Cyril A. Babcock, treasurer; Henry V. A. Joslin, secretary.

JAMAICA, L. I.—The Rockaway Electric Railway Company, with a capital of $250,000, will build a double-track surface street railroad on Rockaway Beach, about four miles in length, beginning at a point on Central avenue near Central street, and running along Central avenue boulevard, Fairview avenue, Potter avenue, Wave Crest avenue, Holland avenue, and ending at the New York, Woodhaven & Rockaway Beach Railroad depot at Hammel's station, has been incorporated.

New Incorporations.

NEW YORK, N. Y.—The American Watchman's Time Detector Company has been incorporated to manufacture electrical appliances; capital, $150,000; incorporators, J. S. Morse, A. G. Morse, New York city; F. N. Reegle, Beaver Falls, Pa.; H. W. Merwin, New York city.

NEW YORK, N. Y.—The Perret Storage Battery Company has been incorporated, with a capital of $100,000, to manufacture storage batteries and all kinds of electrical appliances. The directors are Frank A. Perret and Robert R. Clayton, of Brooklyn, and Omri F. Hibbard, J. Lester Hornicker and Walter I. McCoy, of New York city.

PAWTUCKET, R. I.—The Electrical Supply Manufacturing Company has been incorporated. The incorporators are Lorenzo B Favor and John C. Cudbert, both of this city, and Charles H. Easex, of Providence. The capital stock will be $50,000, and the company will engage in the business of assaying, refining and smelting all kinds of metals, also for the manufacture of all kinds of brass work, also in the buying and selling of all kinds of metals and in business connected therewith and incident thereto.

YONKERS, N. Y. — The Terrace City Improvement and Construction Company has been incorporated, at Albany, with a capital of $100,000, to furnish electricity for lighting purposes in Yonkers. The directors are Oren E. Wilson, of Albany; David L. Gluck, of New York city, and Fremont Wilson, of Yonkers.

Electric Light and Power.

MALONE, N. Y. — The Malone Light and Power Company has been incorporated, with a capital of $75,000. The officers are: President, F. D. Kilburn; secretary and treasurer, J. F. Wright; directors, F. D. Kilburn, J. F. Wright, Fred O'Neil, Geo. S. Howard, N. W. Porter.

DURAND, WIS. — The Durand Light and Power Company has been organized by the election of the following officers: George Tarrant, Jr., Frank Pierce, W. E. Plummer, H. M. Orlandy, E. Osterricher, F. J. Gobar and W. H. Huntington. The capital stock is $25,000.

COLORADO SPRINGS, COLO —The Colorado Springs Light and Power Company is said to be contemplating the extension of its electric lighting business and the early installation of additional electrical machinery. This is the company which succeeded the Colorado Springs Gas and Electric Company.

Increase of Capital.

WAUSEON, OHIO—The Northwestern Ohio Telephone Company has increased its capital stock from $10,000 to $20,000.

CLEVELAND, OHIO—The Forest City Electric Company has increased its capital stock from $25,000 to $100,000.

GALESBURG, ILL.—The Galesburg Gas and Electric Light Company has increased its capital stock from $200,000 to $350,000.